ALBERT R. MANN LIBRARY
AT
CORNELL UNIVERSITY

CORNELL UNIVERSITY LIBRARY
3 1924 074 216 494

DATE DUE

GAYLORD PRINTED IN U.S.A.

QK
600
M992
V.60
1996

MYCOTAXON

AN INTERNATIONAL JOURNAL FOR RESEARCH ON
TAXONOMY & NOMENCLATURE OF FUNGI, INCLUDING LICHENS

Volume LX October-December 1996

CONTENTS

A Catalogue of Types (Uredinales) in the National Mycological Herbarium (DAOM) Ottawa, Canada. . . . . **J. A. Parmalee** 1

Some Stemonitales (Myxomycetes) from the State of Tlaxcala, Mexico. **M. Rodríguez-Palma and A. Estrada-Torres** 79

Studies on Mediterranean Hyphomycetes. III. *Quadracaea mediterranea* anam.-gen. and sp. nov . . . . **D. Lunghini, F. Pinzari and L. Zucconi** 103

Heterobasidiomycetes from Majorca & Cabrera (Balearic Islands). . . . . **Peter Roberts** 111

A New Species of *Callistosporium* . . . . **Raymond M. Fatto and Alan E. Bessette** 125

Scutellospora cerradensis: An Ornamented Species in the Gagasporaceae (Glomales) from the Cerrado Region of Brazil. **Joyce Lance Spain and Jeanne Claessen De Miranda** 129

Glomus brasilianum: An Ornamented Species in the Glomaceae. **Joyce Lance Spain and Jeanne Claessen De Miranda** 137

Royoporus –A New Genus for *Favolus spathulatus* . . . . **A. B. De** 143

Chytridiomycete Taxonomy Since 1960 . . . . **Joyce E. Longcore** 149

Coccoidella exocarpi sp. nov. on *Exocarpos* spp. from Australia. **Z. Q. Yuan, C. Mohammed and T. J. Wardlaw** 175

New and Interesting Wood-Inhabiting Fungi (Basidiomycotina–Aphyllophorales) from Ethiopia . . . . **Kurt Hjortstam and Leif Ryvarden** 181

A New Species of *Bartalinia* Tassi (Deuteromycotina, Coelomycetes). **Freda Anderson and Virginia Bianchinotti** 191

Pinatubo oryzae gen. et sp. nov. and its Identity During Routine Tests of Rice Seed. **J. B. Manandhar and T. W. Mew** 201

A Preliminary Checklist of Agaricales in Turkey . . . . . **Ertugrul Sesli and Saffet Baydar** 213

A New Species of *Thermoascus* with a *Paecilomyces* Anamorph and Other Thermophilic *Thermoascus* Species from Taiwan. **Kuei-Yu Chen and Zuei-Ching Chen** 225

Thielavia pingtungia sp. nov. a Thermophilic Ascomycete from Taiwan. **Kuei-Yu Chen and Zuei-Ching Chen** 241

Hymenoscyphus seminis-alni, a New Species of the *H. fructigenus* - Complex. **Hans Otto Baral** 249

Amoenodochium humicola anam. gen. et sp. nov., a New Sporodochial Hyphomycete from Indian Soil. . . . . **Fernando Peláez and Rafael F. Castañeda Ruíz** 257

Mycena sororia sp. nov., Close to *M. rosea* Gramberg (Basidiomycotina). **J. Perreau-Bertrand, M. C. Boisselier-Dubayle and J. Lambourdiere** 263

[Contents continued inside front cover]

ISSN 0093-4666 MYXNAE 60: 1-524 (1996)

For subscription details, availability in microfilm and microfiche, and availability of articles as tear sheets, see back cover.

[Contents continued from front cover]

Notes on Conidial Fungi. X. A New Species of *Ceratosporella* and Some New Combinations .... **R. F. Castañeda Ruíz, J. Guarro and J. Cano** 275
Some Airborne Conidial Fungi from Cuba.
R. F. Castañeda Ruíz, D. E. Fabré, M. P. Parra, M. Pérez and J. Guarro 283
Egyptian Uredinales. I. Rusts on Wild Plants from the Nile Delta.
Zakaria A. Baka and Halvor B. Gjærum 291
The Genus *Pyrofomes* in Argentina and the Curltural Features of *P. lateritius* (Aphyllophorales).
Jorge E. Wright, Marcela F. Bolontrade and Alejandra T. Fazio 305
Taxonomy of *Fomitopsis rubidus* comb. nov. .... **Anjali Roy and A. B. De** 317
Strigula occulta, a New Saxicolous Lichen from New Zealand.
P. M. McCarthy and W. M. Malcolm 323
Xylaria Species from Papua New Guinea: Cultural and Anamorphic Studies.
Katleen Van der Gucht 327
A New Species of *Hygrocybe* from India.
T. K. Abraham, K. B. Vrinda and C. K. Pradeep 361
NATS Truffle and Truffle-Like Fungi 5: *Tuber lyonii* (=*T. texense*), with a Key to the Spiny-Spored *Tuber* Species Groups.
James E. Trappe, Ari M. Jumpponen and Efrén Cázares 365
Hyphomycetes on *Alchornea triplinervia* (Spreng.)Müll. Arg. Leaf Litter from the Ecological Reserve Juréia-Itatins, State of São Paulo, Brazil.
Rosely Ana Piccolo Grandi and Derlene Silva Attili 373
Bridgeoporus, a New Genus to Accommodate *Oxyporus nobilissimus* (Basidiomycotina, Polyporaceae).
Harold H. Burdsall, Jr., Thomas J. Volk and Joseph F. Ammirati, Jr. 387
A Check List of Higher Marine Fungi on Wood from Danish Coasts.
J. Koch and K. R. L. Petersen 397
Lichenicolous Fungi from the Western Pyrenees, France and Spain. II. More Deuteromycetes. .... **Javier Etayo and Paul Diederich** 415
A New Species of *Botryobasidium* (Corticiaceae, Aphyllophorales) Inhabiting the Interiors of Brown Rotted Logs of Ponderosa Pine .... **Michael J. Larsen**
Alan E. Harvey, Robert Powers and Martin F. Jurgensen 429
Planistromelaceae, a New Family in the Dothideales. .... **Margaret E. Barr** 433
A New Species of *Alysidiopsis* from Mexico.
Angel Mercado Sierra, Maria José Figueras, Julio Mena Portales 443
New and Interesting *Helicoon* Species from Spain.
Samir K. Abdullah, J. Guarro and M. J. Figueras 449
Hyphomycetes from Streams: New Taxa and New Combination.
Ludmila Marvanová and Enrique Descals 455
ALLRUS: A System for Standard Description, Identification and Classification of Russulaceae. **V. Robert and B. Buyck** 471
Helicoon septatissimum sp. nov., a New Species from Tierra del Fuego.
A. M. Godeas and A. M. Arambarri 481
A New Species of *Leptodontidium* from *Quercus acutissima*.
A. Tsuneda, N. Maekawa and R. S. Currah 485
Book Reviews .... **D. S. Hibbett** 491
NOTICE: Transfer of Professor E. J. H. Corner's Mycologial Material 497
Author Index 498
Index to Fungous and Lichen Taxa 501
Reviewers 524
Publications Date, Volume 59 524

© Mycotaxon, Ltd., 1996

MYCOTAXON

AN INTERNATIONAL JOURNAL OF RESEARCH ON
TAXONOMY & NOMENCLATURE OF FUNGI, INCLUDING LICHENS

VOLUME LX, 1996

COMPLETE IN ONE VOLUME
CONSISTING OF iv + 524 PAGES INCLUDING FIGURES

EDITOR-IN-CHIEF

Jean Boise Cargill
Harvard University Herbaria, 22 Divinity Ave.
Cambridge, MA 02138-2094, USA

Pavel Lizon
Assistant to the Editor-in-Chief
Plant Pathology Herbarium
Cornell University, Ithaca, NY 14853

ASSOCIATE EDITORS

David S. Hibbett
Book Review Editor
Harvard University Herbaria, 22 Divinity Ave.
Cambridge, MA 02138-2094, USA

Grégoire L. Hennebert
French Language Editor
32 Rue de l'Elevage
B-1340 Ottignies -LLN, Belgium

Karen Gettelman
Index Editor
Indiana University
Bloomington, IN, USA

EDITORIAL ADVISORY BOARD

JAMES W. KIMBROUGH, Gainesville, Florida (1992-97, *Chm.*)
AMY Y. ROSSMAN, Beltsville, Maryland (1990-96)
GREGOIRE L. HENNEBERT, Louvain-la-Neuve, Belgium (1990-96)
JACK D. ROGERS, Pullman, Washington (1993-98)
OVE ERIKSSON, Umeå, Sweden (1994-99)
RONALD H. PETERSEN, Knoxville, Tennessee (1995-2000)

Published by
MYCOTAXON, LTD.P.O.BOX 264
ITHACA, NY 14851-0264, USA

Printed in the United States of America

© Mycotaxon, Ltd., 1996

Table of Contents, Volume Sixty
October-December 1996

A Catalogue of Types (Uredinales) in the National Mycological Herbarium (DAOM) Ottawa, Canada . . . . **J. A. Parmalee** 1

Some Stemonitales (Myxomycetes) from the State of Tlaxcala, Mexico. **M. Rodríguez-Palma and A. Estrada-Torres** 79

Studies on Mediterranean Hyphomycetes. III. *Quadracaea mediterranea* anam.-gen. and sp. nov . . . .**D. Lunghini, F. Pinzari and L. Zucconi** 103

Heterobasidiomycetes from Majorca & Cabrera (Balearic Islands). . .**Peter Roberts** 111

A New Species of *Callistosporium*. . **Raymond M. Fatto and Alan E. Bessette** 125

Scutellospora cerradensis: An Ornamented Species in the Gagasporaceae (Glomales) from the Cerrado Region of Brazil. **Joyce Lance Spain and Jeanne Claessen De Miranda** 129

Glomus brasilianum: An Ornamented Species in the Glomaceae. **Joyce Lance Spain and Jeanne Claessen De Miranda** 137

Royoporus –A New Genus for *Favolus spathulatus* . . . . **A. B. De** 143

Chytridiomycete Taxonomy Since 1960. . . . . **Joyce E. Longcore** 149

Coccoidella exocarpi sp. nov. on *Exocarpos* spp. from Australia. **Z. Q. Yuan, C. Mohammed and T. J. Wardlaw** 175

New and Interesting Wood-Inhabiting Fungi (Basidiomycotina–Aphyllophorales) from Ethiopia. . . . . **Kurt Hjortstam and Leif Ryvarden** 181

A New Species of *Bartalinia* Tassi (Deuteromycotina, Coelomycetes). **Freda Anderson and Virginia Bianchinotti** 191

Pinatubo oryzae gen. et sp. nov. and its Identity During Routine Tests of Rice Seed. **J. B. Manandhar and T. W. Mew** 201

A Preliminary Checklist of Agaricales in Turkey. **Ertugrul Sesli and Saffet Baydar** 213

A New Species of *Thermoascus* with a *Paecilomyces* Anamorph and Other Thermophilic *Thermoascus* Species from Taiwan. **Kuei-Yu Chen and Zuei-Ching Chen** 225

Thielavia pingtungia sp. nov. a Thermophilic Ascomycete from Taiwan. **Kuei-Yu Chen and Zuei-Ching Chen** 241

Hymenoscyphus seminis-alni, a New Species of the *H. fructigenus* - Complex. **Hans Otto Baral** 249

Amoenodochium humicola anam. gen. et sp. nov., a New Sporodochial Hyphomycete from Indian Soil . . . . . . **Fernando Peláez and Rafael F. Castañeda Ruíz** 257

Mycena sororia sp. nov., Close to *M. rosea* Gramberg (Basidiomycotina). **J. Perreau-Bertrand, M. C. Boisselier-Dubayle and J. Lambourdiere** 263

Notes on Conidial Fungi. X. A New Species of *Ceratosporella* and Some New Combinations. . . . . **R. F. Castañeda Ruíz, J. Guarro and J. Cano** 275

Some Airborne Conidial Fungi from Cuba. **R. F. Castañeda Ruíz, D. E. Fabré M. P. Parra, M. Pérez and J. Guarro** 283

Egyptian Uredinales. I. Rusts on Wild Plants from the Nile Delta. **Zakaria A. Baka and Halvor B. Gjærum** 291

The Genus *Pyrofomes* in Argentina and the Curltural Features of *P. lateritius* (Aphyllophorales). **Jorge E. Wright, Marcela F. Bolontrade and Alejandra T. Fazio** 305

Taxonomy of *Fomitopsis rubidus* comb. nov. . . . . . . **Anjali Roy and A. B. De** 317

Strigula occulta, a New Saxicolous Lichen from New Zealand. **P. M. McCarthy and W. M. Malcolm** 323

Xylaria Species from Papua New Guinea: Cultural and Anamorphic Studies. **Katleen Van der Gucht** 327

A New Species of *Hygrocybe* from India. **T. K. Abraham, K. B. Vrinda and C. K. Pradeep** 361

NATS Truffle and Truffle-Like Fungi 5: *Tuber lyonii* (=*T. texense*), with a Key to the Spiny-Spored *Tuber* Species Groups. **James E. Trappe, Ari M. Jumpponen and Efrén Cázares** 365
Hyphomycetes on *Alchornea triplinervia* (Spreng.)Müll. Arg. Leaf Litter from the Ecological Reserve Juréia-Itatins, State of São Paulo, Brazil. **Rosely Ana Piccolo Grandi and Derlene Silva Attili** 373
Bridgeoporus, a New Genus to Accommodate *Oxyporus nobilissimus* (Basidiomycotina, Polyporaceae) . . . . **Harold H. Burdsall, Jr. Thomas J. Volk and Joseph F. Ammirati, Jr.** 387
A Check List of Higher Marine Fungi on Wood from Danish Coasts. **J. Koch and K. R. L. Petersen** 397
Lichenicolous Fungi from the Western Pyrenees, France and Spain. II. More Deuteromycetes. . . . . **Javier Etayo and Paul Diederich** 415
A New Species of *Botryobasidium* (Corticiaceae, Aphyllophorales) Inhabiting the Interiors of Brown Rotted Logs of Ponderosa Pine . . . . . . **Michael J. Larsen Alan E. Harvey, Robert Powers and Martin F. Jurgensen** 429
Planistromelaceae, a New Family in the Dothideales. . . . . **Margaret E. Barr** 433
A New Species of *Alysidiopsis* from Mexico. **Angel Mercado Sierra, Maria José Figueras, Julio Mena Portales** 443
New and Interesting *Helicoon* Species from Spain. **Samir K. Abdullah, J. Guarro and M. J. Figueras** 449
Hyphomycetes from Streams: New Taxa and New Combination. **Ludmila Marvanová and Enrique Descals** 455
ALLRUS: A System for Standard Description, Identification and Classification of Russulaceae. **V. Robert and B. Buyck** 471
Helicoon septatissimum sp. nov., a New Species from Tierra del Fuego. **A. M. Godeas and A. M. Arambarri** 481
A New Species of *Leptodontidium* from *Quercus acutissima*. **A. Tsuneda, N. Maekawa and R. S. Currah** 485
Book Reviews . . . .**D. S. Hibbett** 491
NOTICE: Transfer of Professor E. J. H. Corner's Mycologial Material. 497
Author Index 498
Index to Fungous and Lichen Taxa 501
Reviewers. 524
Publications Date, Volume 59 524

MYCOTAXON

Volume LX, pp. 1-77 October-December 1996

A CATALOGUE OF TYPES (UREDINALES) IN THE NATIONAL MYCOLOGICAL HERBARIUM (DAOM) OTTAWA, CANADA

J.A. PARMELEE

Centre for Land and Biological Resources Research
C.E.F. Ottawa, Ontario, Canada KlA OC6

ABSTRACT

A search for type specimens of rusts in Canada's National Mycological Herbarium found over 500 amongst the 50,000 specimens of rusts. These are recorded in tabular format indicating hosts (and families), DAOM accession number, exsiccati name and number if applicable, collector and number if available and the specified type.

INTRODUCTION

At a symposium on taxonomy of rust fungi at the 4th International Mycological Congress in Germany in 1990, it was proposed that a record of nomenclatural type specimens held in various herbaria would prove a useful aid to workers in this field. Herein is a record of all such types in the National Mycological Herbarium (DAOM). Fungus collections began in DAOM mainly with the appointment of the first Dominion Botanist for Canada in 1909, but holdings today date even earlier with the purchase and exchange of specimens from Asia, Europe and the United States. Authors of some of our larger exsiccati include: Ellis and Everhart (Fungi Columbiani 1-5100 and North American Fungi 1-2900), Rabenhorst (Fungi Europaei 1-4100), Petrak (Mycotheca Generalis 101-2100), Bartholomew (North American Uredinales 1-3500), Sydow (Uredineen 1001-2650), Thuemen (Mycotheca Universalis 1-2300).

One smaller exsiccati obtained in the 1950's dates from 1810 by Mougeot.

Some of our exchange material includes specimens from Holway (Mexico, Central and South America), Arthur (North America), Cummins (North America), N. Hiratsuka (Japan) and H.S. Jackson (South America). At this writing the National Mycological Herbarium contains over 300,000 specimens of all major groups of fungi and I estimate that 50,000 are rusts. In this review I found about 1% to be types - 629 by count.

As outlined in the International Code of Botanical Nomenclature (ICBN) W. Greuter *et al.* (1994), nomenclature in the fungi dates from 1753 but names of rusts adopted by Persoon (1801) are sanctioned i.e. treated as if conserved against earlier homonyms and competing synonyms. Nomenclatural types as delimited in ICBN Art. 9 include:

HOLOTYPE - the one specimen or illustration used by the author, or designated by the author as the nomenclatural type.

ISOTYPE - any duplicate of the holotype.

SYNTYPE - any one of two or more specimens cited in the protologue when no holotype was designated.

PARATYPE - a specimen cited in the protologue that is neither holotype nor an isotype, nor one of the syntypes.

LECTOTYPE - a specimen or illustration designated as the nomenclatural type when no holotype was designated.

NEOTYPE - a specimen or illustration selected to serve as nomenclature type as long as all of the material on which the name of the taxon was based is missing.

TOPOTYPE - a later collection from the type locality (ex. ICBN 1981).

Types reported here have been transferred to specially marked standard herbarium sheets with bold cross-hatching about 2-3 cm. high completely across the bottom of both sides. These sheets are restricted for a type specimen and any notes, photographs, drawings or slides from same plus the original description.

Generic names of rusts included are based on Cummins and Hiratsuka (1983). The specific and subspecific taxa are as they appear on the labels, but if now known to have been reduced to synonomy, the recognized epithet is included in parentheses (= .....). Doubtless other taxa may prove to be synonyms also. Basionyms are likewise included in parentheses but without the equals symbol. The genera and species are listed alphabetically but in those genera having numerous species, like *Puccinia* and *Uromyces*, the species are listed alphabetically within host families. For example *Puccinia shiraiana* is the fourth species listed under the first alphabetical family Acanthaceae, *P. arabicola* is the second species under Brassicaceae and *P. aegopogonis* is the first of 35 species under Poaceae. Taxa of *Puccinia* on Asteraceae are numerous (175) and host tribes in this family are also sequenced (Asteraceae/Anthemideae, Asteraceae/Astereae, Asteraceae/Cardueae....) with rust taxa alphabetically under each tribe. Employment of hosts in this manner reflects arrangement in DAOM. Included under the remarks column are: the DAOM number, the collector's name and number or an exsiccati name and number, occasionally a related note and a designation of type in bold face. Delimited types are given when clearly obvious otherwise as indicated on the specimen label e.g. type material, part of the type or simply type. Herbaria are designated as in the eighth edition of Index Herbariorum by P.K. Holmgren *et al.* (1990) and the private collection of N. Hiratsuka is abbreviated as HH following the treatment in N. Hiratsuka *et al.* (1992). Authors of rust taxa cited regularly throughout are abbreviated: J.C. Arthur (Arth.), G.B. Cummins (Cumm.), P. Dietel (Diet.), Nahoide Hiratsuka (Hirats. f.), E.W.D. Holway (Holw.), H.S. Jackson (Jacks.); otherwise names are abbreviated according to Arthur and Cummins (1962) or spelled in full.

ACKNOWLEDGEMENTS

For their reviews of the manuscript, I am grateful to Dr. Y. Hiratsuka, Northern Forestry Centre, Edmonton, Alberta and Dr. G.B. Cummins, Tucson, Arizona. In-house reviews were by Drs. J. Ginns and S.A. Redhead and I also acknowledge the aid by staff of the National Mycological Herbarium, Ottawa in preparing camera ready copy for publication.

REFERENCES

Arthur J.C. and G.B. Cummins (1962). Manual of the rusts of United States and Canada. Hafner, New York. 438 pp.

Cummins G.B. and Y. Hiratsuka (1983). Ilustrated genera of rust fungi - Rev. ed. American Phytopathological Society, St. Paul, Minn. 152 pp.

Greuter W., F.R. Barrie, H.M. Burdet, W.G. Chaloner, V. Demoulin, D.L. Hawksworth, P.M. Jorgensen, D.H. Nicolson, P.C. Silva, P. Trehane, J. McNeil (1988). International Code of Botanical Nomenclature. (Tokyo Code). Koeltz Scientific Books. Königstein, Germany. 389 pp.

Hiratsuka N., S. Sato, K. Katsuya, M. Kakishima, Y. Hiratsuka, S. Kaneko, Y. Ono, T. Sato, Y. Harada, T. Hiratsuka and K. Nakayama (1992). The rust flora of Japan. Tsukuba Shippankai, Tsukuba, Japan. 1205 pp. + index 159 pp.

Holmgren P.K., N.H. Holmgren and L.C. Barnett (1990). Index Herbariorum 8th ed. Regnum Veg. 120:1-693.

Persoon C.H. (1801). Synopsis methodica fungorum. Gottingen. 706 pp.

TYPE COLLECTIONS (UREDINALES) IN DAOM

BINOMIAL	HOST	REMARKS
AECIDIUM		
ageratinae Savile	Ageritina altissima (L.) King & Robins. (= Eupatorium rugosum)	DAOM 3912, Savile [Holotype] isotype to PUR
borrichiae Syd.	Borrichia frutescens (L.) DC.	DAOM 6428, Alabama, Seymour [Isotype]
chuquiraguae Jacks. & Holw.	Chuquiragua sp.	DAOM 76012, Holw. 1743 [Isotype]
hornotinum Cumm.	Meliosoma ?multiflora Merrill	DAOM 24393 ex PUR [Isotype]
ivae Jacks.	Iva frutescens L.	DAOM 20858, Jacks. 1676 ex TRTC [Isotype]
leonense Cumm.	Dioscorea sp.	DAOM 19341, Deighton 2282 ex IMI [part of Type]

Aecidium cont'd.

ligustricola Cumm.	Ligusticum sp.	DAOM 43863, Cheo 2238 [part of **Type**]
millae Jacks. & Holw.	Milla poeppigiana Baker	DAOM 76054, Holw. 249a **[Isotype]**
minimum Jacks. & Holw.	Stevia urticaefolia Thunb.	DAOM 76055, Holw. 1366 **[Isotype]**
mundula Jacks. & Holw.	Solanum pulchellum Phil.	DAOM 76058, Holw. 63 **[Isotype]**
nectandrae Jacks. & Holw.	Nectandra oppositifolia Mass.	DAOM 76059, Holw. 1339 **[Isotype]**
papudensis Jacks. & Holw.	Solanum runcinatum R. & P.	DAOM 76063, Holw. 38 **[Isotype]**
pereskiae Jacks. & Holw.	Pereskia grandifolia Haw.	DAOM 76064, Holw. 1308 **[Isotype]**
poecilochromae Jacks. & Holw.	Poecilochroma quitensis Miers	DAOM 78360, Holw. 363 **[Isotype]**
pulverulentum Arth.	Randia xalapensis Mart. & Gal.	DAOM 108815, Holw. 5115 **[Syntype]**
pratae Jacks.	Amaranthaceae	DAOM 76072, Holw. 1716 **[Isotype]**
punicium Juel	Thapsia garganica L.	DAOM 76076, O. Juel **[Isotype]**
tenebrosum Jacks. & Holw.	Alstroemeria sp. (= A. alstroemeriae Diet. & Neg.)	DAOM 76001, Holw. 42 **[Isotype]**

ARTHURIA		
catenulata Jacks. & Holw.	Croton sp.	DAOM 76113, Holw. 1046 [Isotype]
ARTHURIOMYCES		
peckiana (Howe in Pk.) Cumm. & Y. Hirats. (Gymnoconia p.)	Rubus occidentalis L.	Type not in DAOM; replacement genus for Gymnoconia fide Cumm. & Y. Hirats. (1983)
BAEODROMUS		
californicus Arth.	Senecio douglassi DC.	DAOM 169223, Parish 2562 [Isotype]
eupatorii (Arth.) Arth. (Dietelia e.)	Eupatorium pazcuarense HBK.	DAOM 108818, Holw. 5205 [Isotype]
holwayi Arth.	Senecio cinerarioides HBK.	DAOM 108819, Holw. 5160 = Vest., Micro. Rar. Sel. 1003 in DAOM [Isotypes]
BOTRYORHIZA		
hippocrateae Whetzel & Olive	Hippocratea volubilis L.	DAOM 76117, Whetz. & Olive 87 [Isotype]

CERACEOPSORA		
elaegni Kakishima, T. & S. Sato	Elaeagnus umbellata Thunb.	DAOM 191804, T. Sato R411 **[Isotype]**
CEROTELIUM		
holwayi Jackson	Bignoniaceae	DAOM 76141, Holw. 1315 **[Isotype]**
CHRYSOCYCLUS		
mikaniae (Arth.) Syd. (Chrysopsora m.)	Mikania buddleiaefolia DC.	DAOM 76151, Holw. 1159 **[Isotype]**
CHRYSOMYXA		
ilicina (Ell. & Ev.) Arth. (Aecidium i.)	Ilex	DAOM 23563 ex PUR 44344, Nuttall 839 [Paratype]
ledi (Alb. & Schw.) de Bary		
var. glandulosi Savile	Ledum glandulosum Nutt.	DAOM 45484 [**Holotype** of var.]; isotypes to BPI, FH, MICH, PUR, TRTC, IMI, O, S
var. groenlandici Savile	Ledum groenlandicum Oeder	DAOM 45442 [**Holotype** of var.]; isotypes to BPI, MICH, PUR, TRTC, IMI, S

Chrysomyxa cont'd.		
var. vaccini Ziller	Vaccinium parvifolium J.E. Sm.	DAOM 46500 = DAVFP 9450 [**Isotype** of var.]; isotype also to PUR
monesis Ziller	Moneses uniflora (L.) A. Gray	DAOM 36510 = DAVFP 7759 [**Paratype**]; **Holotype** in DAVFP 7789
weirii Jacks.	Picea engelmanii Parry	DAOM 76193, Weir 271 [**Isotype**]
CHRYSOPSORA		
gynoxidis Lagerh.	Gynoxis pulchella Cass.	DAOM 76202, Lagerheim, Jan. 1891 [**Isotype**]
COLEOSPORIUM		
adenocaulonis Jacks.	Adenocaulon bicolor Hook.	DAOM 76205, Jacks. 1549 [telia not descr.!]
anceps Diet. & Holw. in Holw.	Verbesina sphaerocephala A. Gray	DAOM 108823, Holw. 3501 [**Syntype**]
begoniae Arth.	Begonia sp.	DAOM 76213, Holw. 5064 [part of **Type**]

Coleosporium cont'd.

cheoanum Cumm.	Coleus sp.	DAOM 43859, Cheo 548 [part of **Type**]
choerospondiatis Wang & Zhuang	Choerospondias axillaris (Roxb.) Burtt & Hill	DAOM 187334, Zhuang 206 **[Isotype]**
crowellii Cumm.	Pinus flexilis James	DAOM 23346 & 204067, Crowell 53 **[Isotypes]** ex MTMG
elephantopodis Thuem.	Elephantopus carolineanus Willd.	Thuem., Myc. Univ. No. 953 in DAOM **[Isotype]**
paraphasatum Diet. & Holw. in Holw.	Liabum discolor Benth. & Hook.	DAOM 76279 & 108835, Holw. 3483 **[Isotype]**
rubiicola Cumm.	Rubia cordifolia L.	DAOM 43844, Cheo 810 [part of **Type**]
steviae Arth.	Stevia trachelioides (DC.) Hook.	Vest., Micro. Rar. Select. 1006 in DAOM [part of **Type**]
verbesinae Diet.	Verbesina sp.	DAOM 76334, Holw. 3542 **[Syntype]**
viguierae Diet. & Holw.	Viguiera helianthoides HBK.	DAOM 108840, Holw. s.n. **[Isotype]**

CRONARTIUM

occidentale Hedgc., Bethel & Hunt	Ribes aureum Pursh	DAOM 76388 ex USDA 75509 **[Topotype]**

Cronartium cont'd.		
ribicola Fischer	Ribes aureum Pursh	Rab., Fungi Europ. 1595 in DAOM **[Isotype]**
CUMMINSIELLA		
wootoniana (Arth.) Arth. (Uropyxis w.)	Mahonia haematocarpa (Wooton) Fedde	DAOM 76419, 9 Aug. 1908, E.O. Wooton **[Isotype]**
DICHEIRINIA		
superba Jacks. & Holw.	Inga sp.	DAOM 76438, Holw. 1234 **[Type material]**
DIDYMOPSORA		
chuquiraguae Diet. [see Diet., Hedwigia 38:254 1899]	Chuquiragua tomentosa Bak.	DAOM 76426, E. Ule, Herb. Brasiliense 1076 Apr. 1897 **[Paratype]**
triumfettae Jacks. & Holw.	Triumfetta longicornis St. Hil.	DAOM 76429, Holw. 1405 **[Type material]**
DIETELIA		
holwayi (Jacks.) Bur. & Henn. (Endophyllum h.)	Salpichroa	DAOM 76444, Holw. 582 **[Isotype]**

EDYTHEA		
tenella Jacks. & Holw.	Berberis divaricata Rusby	DAOM 76438, Holw. 564 [Type material]
ENDOPHYLLUM		
alaskanum Savile	Epilobium anagallidifolium Lam. as E. alpinum	DAOM 55713, Calder 6282a [Holotype]
lacus-regis Savile & Parmelee	Claytonia caroliniana Michx.	DAOM 46405, Savile 3236 [Holotype]; isotypes to numerous herbaria
GYMNOSPORANGIUM		
betheli Kern	Juniperus scopulorum Sarg.	DAOM 133338 (notes only) ex PUR 10536, specimen poor by insect damage [ex Type material]
bermudianum Earle	Juniperus virginiana L.	DAOM 179624 ex FH [Syntype]
connersii Parmelee	Juniperus horizontalis Moench	DAOM 75212, Parmelee 519 & Conners [Holotype]
davisii Kern	Juniperus communis L.	DAOM 7828 and 76471, Wind L., Wisc., J.J. Davis [Paratype]

Gymnosporangium cont'd.

durum Kern	Sabina utahensis Rydb.	DAOM 133340 (slide only), ex PUR 11119 [part of **Type**]
ellisii Ellis	Chamaecyparis thyoides (L.) B.S.P.	Ell., N. Am. Fungi 271 in DAOM [**Isotype**] note: telia not described but obvious in specimen
fraternum Kern	Chamaecyparis thyoides (L.) B.S.P.	Ell., N. Am. Fungi 1479 in DAOM [**Isotype**]
gaeumanii Zogg	Juniperus nana Willd.	DAOM 118966 ex Type in Bot. Samm. Tech. Hochschule, Zurich [part of **Type**]
ssp. albertensis Parmelee	Juniperus communis L.	DAOM 126028, Parmelee 3563 & Y. Hiratasuka [**Holotype** of ssp.]
haraeanum Syd. (= G. asiaticum Miyabe ex Yamada)	Juniperus chinensis	DAOM 133342 (slide only), ex Syd., Fungi Exot. Exs. 6 in DAOM [part of **Type**]
harknessianium Arth.	Juniperus occidentalis Hook.	DAOM 167566 = PUR 9507, Bethel 5271 [**Topotype**]
nelsonii Arth.	Juniperus scopulorum Sarg.	DAOM 133341 (slide only) = PUR 11070 [part of **Type**]
nootkatense (Trel.) Arth. (Uredo n.)	Chamaecyparis nootkataenis (Lamb) Spach.	DAOM 76547 = Herb. Cain 8262, Barso 9005 [**Topotype**]

HAMASPORA		
longissima (Thuem.) Korn. (Phragmidium l.)	Rubus rigidus Sm.	Thuem., Myco. Univ. 542 in DAOM **[Isotype]**
ozeenis Hirats. f.	Rubus pectinellus Maxim.	DAOM 32717, ex HH 1036 [part of **Type]**
HEMILEIA		
oxyanthi Cumm.	Oxyanthus speciosus DC.	DAOM 192307, Hansford [ex **Type]**
HYALOPSORA		
adianti-capilli-vernis (DC.) Syd. (Uredo a.)	Adianthum capilli-veneris L.	DAOM 76567 = Syd., Ured. 1691 **[Isotype]**
diplazii Hirats. f.	Diplazium squamigerum Christ.	DAOM 29844 ex HH 163 [part of **Type]**
polypodii Magn. as Uredo linearis var. b polypodii Pers.	Cystopteria fragilis (L.) Bernh. as Dryopteris fragilis	[many European specimens from 1880's in DAOM but earliest is Mougeot & Nestler, Stirpes Cryptogamae no. 289, 1812.]

KUEHNEOLA

ramacharii Bagyan. & Niran.	Gymnosporia montana (Wright & Arn.) Benth. & Hook. f.	DAOM 188635 [**Holotype**]

MAINSIA

clara Jacks. & Holw.	Rubus sp.	DAOM 76603 = Holw. 963 [**Isotype**]
holwayii Jacks. & Holw.	Rubus spp.	DAOM 76604 = Holw. 673A, 76605 = Holw. 722, 76606 = Holw. 720 [**Paratypes**]
tenella Jacks. & Holw.	Rubus bogotensis HBK.	DAOM 76612 = Holw. 810 [**Isotype**]

MELAMPSORA

aleuritidis Cumm.	Aleurites sp.	DAOM 43834, Cheo 730 [part of **Type**]
epitea Thuem. f. sp. tsugae Ziller	Salix scouleriana Barratt	DAOM 58407 ex DAVFP 9627 [**Isotype** of f. sp.]
lini (Ehrenb.) Lev. (as Uredo l. DC.)	Linum catharticum L.	[Mougeot & Nestler, Stirpes Crypt. 90 in DAOM 58718 is earliest collection (1810) in DAOM but not type]
piscariae Jacks.	Piscaria setigera (Hook.) Piper	DAOM 76705 and 76706, Jacks. 3308 [**Type**]

MICRONEGERIA		
alba Oehrens & Peterson	Nothofagus alpina (Poepp. & Endl.) Oerst.	DAOM 167696 = HFV 1288, Oehrens [**Isotype**]
MILESINA		
asplenii-incisa (Faull) Hirats. f. (Milesia a.)	Asplenium incisum Thunb.	DAOM 29748 [part of **Type**]. Note: telia not described, but from a Uchida coll'n. 2520
blechnicola Hirats. f.	Blechnum nipponicum Mak. as Spicantopsis nipponica var. japonica	DAOM 29754 ex HH 73 [part of **Type**]
faulliana Hirats. f. & Uemura	Cyrtomium fortunei J. Sm.	DAOM 29792 ex HH 111 [part of **Type**]
feurichii (Magn.) Magn.	Asplenium septentrionale (L.) Hoffm.	DAOM 76764 = Syd., Ured. 1550 sub Uredo scopelandii [**Topotype**]
jezoensis Kamei & Hirats. f.	Polypodium vulgare L.	DAOM 76781, Kamei [**Topotype**]
kameiana Hirats. f.	Blechnum amabile Mak.	DAOM 29799, Hirats. f. ex HH 118 [part of **Type**]
kriegeriana (Magn.) Magn. (Melampsorella k.)	Dryopteris carthusiana (Vill.) H.P. Fuchs sub Aspidium spinulosum	DAOM 76782 = Syd., Ured. 1634 in DAOM, sub Melampsorella kriegeriana P. Magn. as cited by Faull (1932) [**Isotype**]

Milesina cont'd.		
laeviuscula (Diet.) Hirats. f. (Uredo l.)	Polypodium californicium Kaulf.	DAOM 57338, Morin Co., Cal., Parks 3316 [Topotype]
tobinagai Hirats. f.	Woodwardia japonica Sw.	DAOM 29821, Tobinaga ex HH 140 [part of Type]
vogesiaca (Faull) P. & H. Sydow (Milesia v.)	Aspidium lobatum Huds.	DAOM 76791 & 76792 = Syd., Myc. Germ. 878; from central Voges, France [Isotype]
NOTHORAVENELIA		
japonica Diet.	Securinega fluggeoides Muell.	DAOM 76795, Yoshinaga [part of Type]
NYSSOPSORA		
koelreuteriae (Syd.) Tranz. (Triphragmium k.)	Koelreuteria paniculata Lam.	Syd., F. Exot. Exs. 114 as Triphragmium k. in DAOM [Isotype]
PERIDERMIUM		
yamabense Saho & I. Takahashi	Pinus pumila L.	DAOM 178193 ex TUFH 5631 [part of Type]

PHAKOPSORA		
cheoana Cumm.	Cedrela sinensis Jues.	DAOM 43820 ex MICH, Cheo 789 [part of Type]
ehretiae Hirats. f.	Ehretia thyrsiflora Nakai	DAOM 32226 ex HH [part of Type]
psoraleae Jacks. & Holw.	Psoralea glandulosa L.	DAOM 76822, Holw. 521 [Isotype] but III not recorded
tecta Jacks. & Holw.	Commelina quitensis Benth.	DAOM 76825, Holw. 536 [Isotype]
PHRAGMIDIUM		
andersoni Shear	Potentilla fruticosa (L.) Rydb.	Herb. Dearness 3464 in DAOM [Type collection]
fusiforme Schroet. var. novi-boreale Savile	Rosa acicularis Lindl.	DAOM 147301, Calder 15443 et al. [Holotype of var.]
guatemalense Cumm.	Potentilla heterosepala Fritsch.	DAOM 108583, Holw. 572 [Isotype]
itoanum Hirats. f.	Potentilla matsuramae Wolf	DAOM 32788, HH 1107 [part of Type]

Phragmidium cont'd.		
ivesiae Syd. ssp. wyomingense Peterson (= P. boreale Tranz.)	Potentilla concinna Rich.	DAOM 61234, Myco. Saxi. Exs. 724 [**Isotype** of spp.]
PHRAGMOPYXIS		
acuminata (Long) Syd. (Tricella a.)	Coursetia glandulosa A. Gray	DAOM 76914, Long 4917 [part of **Type**]
PHYSOPELLA		
meliosmae (Kus.) Cumm. & Ram. (Phakopsora m.)	Meliosma myriantha Sieb. & Zucc.	DAOM 32250, S. Kusano, ex HH [part of **Type**]
PILEOLARIA		
clemensiae Cumm. (= P. pistaciae Tai & Wei)	Pistacia chinensis Bunge	DAOM 4826 & 76919 [**Isotype**]
PROSPODIUM		
amphilophii (Diet. & Holw.) Arth. (Puccinia a.)	Pithecoctenium hexagonum DC. (as Amphilophium h.)	DAOM 108854, Holw. s.n. [part of **Type**]

Prospodium cont'd.

anomalum Jacks. & Holw.	Bignoneaceae	DAOM 76930, Holw. 1997 [Isotype]
arrabidaeae Jack. & Holw.	Arrabidaea (near A. blanchetti DC.)	DAOM 76933, Holw. 1354 [Isotype]
cremastrum Jacks. & Holw.	Cremastrum sceptrum Bur. & Schum.	DAOM 76935, Holw. 1331 [Isotype]
cyathiforme Cumm.	Lundia sp.	DAOM 76936, Holw. 1908 [Type]
depallens (Arth. & Holw.) Cumm. (Puccinia d.)	Pithecoctenium muricatum DC.	DAOM 77549 = 108558, Holw. 365 [Isotype]
holwayi Jacks.	Pithecoctenium sp.	DAOM 76937, Holw. 1541 [Type]
impolitum Jacks. & Holw.	Pyrostegia venusta (Vell.) Presl	DAOM 77880, Holw. 1958 [Type]
lundiae Jacks. & Holw.	Lundia nitidula DC.	DAOM 76939, Holw. 1563 [Type]
palmatum Jacks. & Holw.	Tecoma alba Schum.	DAOM 75640, Holw. 1722 [Type]
permagnum (Arth. & Holw.) Cumm. (Puccinia p.)	Lippia myriocephala Schl. & Cham.	DAOM 108594, Holw. 404 [Isotype]
reticulatum Jacks. & Holw.	Bignoniaceae	DAOM 76941, Holw. 1942 [Type]
stizophyllii Jacks & Holw.	Stizophyllum perforatum Miers	DAOM 76942, Holw. 1613 [Type]

Prospodium cont'd.		
tecomicola (Speg.) Jacks. & Holw. (Puccinia t.)	Tecoma ovalacea=T. araliacea DC.	DAOM 78767, Spegazzini [part of **Type**]
PUCCINIA	**Acanthaceae**	
anisicanthi Diet. & Holw.	Anisicanthus sp.	DAOM 108866, Holw. 3595 [**Isotype**]
praevara Jacks & Holw.	Ruellia viscidus Nees	DAOM 78711, Holw. 800 [**Isotype**]
shiraiana Syd.	Justicia procumbens Rose	Syd., Ured. 1277 in DAOM [**Isotype**]
tetramerii Seym.	Tetramerium aureum Rose	DAOM 90428, Pringle's Mexican Fungi No. 9 in DAOM [**Isotype**]
	Alliaceae	
dichelostemmae Diet. & Holw.	Brodiaea pulchella (Salisb.) Greene as Dichelostemma	Barth., N. Am. Ured. 139 in DAOM, Suksdorf, Apr.-May, 1894 [**Isotype**] DAOM 77545, also Suksdorf, May 1899 [**?Isotype**]
nothoscordi Jacks. & Holw.	Nothoscordum sp.	DAOM 78161, Holw. 741 [**Isotype**]
	Amaranthaceae	
obesispora Arth.	Gomphrena decumbens Jacq.	DAOM 108974, Holw. 3732 [**ex Type**]

Puccinia cont'd.	**Amaryllidaceae**	
pallor Arth. & Holw.	Bomaria	DAOM 108715, Holw. 562 [Type]
	Apiaceae	
cymopteri Diet. & Holw.	Cymopterus terebinthus (Hook.) T. & G.	Barth., N. Am. Ured. 1236 in DAOM [Type coll'n.]
ssp. oregonensis Savile	Pteryxia terebinthina (Hook.) C. & R.	DAOM 107258 ex DAO [Holotype of ssp.]
discors Jacks. & Holw.	Corium maculatum L.	DAOM 77565, Holw. 62 [Isotype]
erigeniae (Orton) Arth. (Allodus e.)	Erigenia bulbosa (Michx.) Nutt.	DAOM 77625 [Topotype]
grahami Cunn.	Aciphylla monroi Hook. f.	DAOM 54951 ex PDD [part of Type]
grenfelliana Savile	Conioselinum chinense (L.) B.S.P.	DAOM 54584, Savile 2636 & Vaill. [Holotype]
mundula Jacks. & Holw.	Osmorrhiza sp.	DAOM 78141, Holw. 610 [Type material]
pimpinellae (Str.) Röhl. ssp. carlottae Savile	Osmorrhiza chilensis Hook. & Arn.	DAOM 106826, Calder 21965 et al. [Holotype of ssp.]
poromera Holw.	Angelica dilatata Nels.	DAOM 108467 [Type coll'n.]
repentina Jacks. & Holw.	Arracacia xanthoriza Bauer	DAOM 78495, Holw. 563 [Type material]

Puccinia cont'd.	**Apocynaceae**	
mandevilleae Jacks. & Holw.	Mandevillea mondoni Rusby	DAOM 78041, Holw. 556 [**Type** material]
	Asclepiadaceae	
oxypetali Henn.	Oxypetalum banksii Schult.	DAOM 78223, Ule, Mycoth. Brasiliensis 9 [?**Type** material]
	Asteraceae/Anthemideae	
achilleae Cke.	Achillea albicaulis Mey.	DAOM 76971, ex Herb. Cain ?ex PUR [**Type** material]
baeumleriana Bubak	Anthemis tinctoria L.	DAOM 77174, = Syd., Ured. 2161 in DAOM [**Type** material]
	Asteraceae/Astereae	
albula Jacks. & Holw.	Baccharis sp.	DAOM 77000, Holw. 1149 [**Isotype**]
alia Jacks. & Holw.	Baccharis trinervis (Lam.) Pers.	DAOM 77004, Holw. [**Paratype**]
baccharidis-spartea Jacks. & Holw.	Baccharis spartea Benth.	DAOM 77173, Holw. 663 [**Isotype**]
brachycomes McAlpine	Brachycome ciliaris Less.	DAOM 77218, Reader, 24 May 1896 [**Type** material]

Puccinia cont'd.	**Asteraceae/Astereae cont'd.**	
consueta Jacks. & Holw.	Baccharis nr. salienta Rusby	DAOM 77454, Holw. 940 [Type material]
consulta Jacks. & Holw.	Baccharis orgyalis DC.	DAOM 77456, Holw. 1176 [Type material]
excursionis Savile	Erigeron peregrinus (Pursh) Greene	DAOM 106335, Savile 4886 [Holotype]
expetiva Jacks. & Holw.	Baccharis sp.	DAOM 77649, Holw. 821 or 831 [Type material]
heterothalami Jacks. & Holw.	Heterothalamus boliviensis Wedd.	DAOM 77810, Holw. 493 [Isotype]
impolita Jacks. & Holw.	Baccharis scandens Pers.	DAOM 77873, Holw. 546 [Isotype]
improcera Jacks. & Holw.	Baccharis anomala DC.	DAOM 77876, Holw. 1740 [Isotype]
incomposita Jacks. & Holw.	Baccharis sp.	DAOM 77891, Holw. 1814 [Isotype]
indagata Jacks. & Holw.	Baccharis sp.	DAOM 77893, Holw. 1537 [Isotype]
inopina Jacks. & Holw.	Baccharis feindalensis HBK.	DAOM 77896, Holw. 917 [Isotype]
interjecta Jacks.	Baccharis lancifolia Less.	DAOM 108688, Holw. 103 [Isotype]
perincerta Jacks. & Holw.	Baccharis tridenta Vahl	DAOM 78266, Holw. 11 [Isotype]
perspicabilis Jacks. & Holw.	Baccharis sp.	DAOM 78275, Holw. 797 [Isotype]
pervenusta Jacks. & Holw.	Baccharis sp.	DAOM 78279, Holw. 663 [Isotype]

Puccinia cont'd.	**Asteraceae/Asterae cont'd.**	
praeculta Jacks. & Holw.	Baccharis sp.	DAOM 78406, Holw. 635 **[Isotype]**
ripulae Mains (= P. melampodii)	Baccharis glutinosa Pers.	DAOM 24398, Clover 1130 [part of **Type**]
ruderaria Jacks. & Holw.	Baccharis near oxydonta DC.	DAOM 78565, Holw. 1291 **[Isotype]**
russa Arth. & Cumm. var. leptotricha Hennen	Erigeron simplex Greene	DAOM 114143, Hennen 63-116 **[Isotype** of var.]
salebrata Jacks. & Holw.	Baccharis sp.	DAOM 78581, Holw. 624 **[Isotype]**
sphenica Arth.	Baccharis sordescens DC.	DAOM 109017, Holw. 5266 **[Isotype]**
	Asteraceae/Cardueae	
acarnae Syd.	Pycnomon acarna (L.) Cass.	DAOM 76967 = Syd., Ured. 1564 in DAOM **[Isotype]**
altissimorum Savile	Cirsium discolor (Muhl.) Spreng.	Ell. & Ev., N. Am. Fungi 2253 in DAOM as P. compositarum Schlect. **[Holotype]**
californicae Diet. & Holw.	Cirsium ?tiogonum (Congd.) Petrak as Cnicus brewi	DAOM 118996 (slide only), Holw. s.n. [ex **Isotype** in UC]

Puccinia cont'd.	**Asteraceae/Cardueae cont'd.**	
centaureae DC. var. diffusa Savile	Centaurea diffusa Lam.	DAOM 132917, Kovalev [**Holotype** of var.]
cyani Pass.	Centaurea cyanus L. var. cyani	DAOM 132845 = Rab., Fungi Europ. 1767 in DAOM [**Isotype**]
var. sublevis Savile	Centaurea cyanus L.	DAOM 14068, Foster [**Holotype** of var.]
inclusa Syd. var. boreohesperia Savile	Cirsium edule Nutt.	DAOM 133051, Savile 5040 [**Holotype** of var.]
var. brevifolia Savile	Cirsium brevifolium Nutt.	DAOM 77394, Zundel [**Holotype** of var.]
var. flodmannii Savile	Cirsium flodmanii (Rydb.) Arth.	DAOM 581, Conners & Sallans [**Holotype** of var.]
var. mexicana Savile	Cirsium sp.	in PUR, Holw. 3730 [**Holotype** of var.]
irrequisita Jacks.	Centaurea americana Nutt.	Barth., N. Am. Ured. 1338 in DAOM as P. centaureae [**Isotype**]
kwangsiana Cumm.	Saussurea sp.	DAOM 43789, Cheo 2742 [part of **Type**]
laschii Lagerb. var. fennica Savile	Cirsium heterophyllum (L.) Hill	DAOM 75911, L. & H. Rovainen, Finland [**Holotype** of var.]
var. palustris Savile	Cirsium palustre (L.) Scop.	DAOM 25229, G. Lagerheim, Sweden [**Holotype** of var.]

Puccinia cont'd.	**Asteraceae/Carduceae cont'd.**	
var. pannonici Savile	Cirsium pannonicum (L. f.) Lk.	Linh., Fungi Hung. 321(a) in DAOM [Holotype]
var. xerophila Savile	Cirsium hydrophyllum (Greene) Jeps.	DAOM 132910, Cal. [Holotype of var.]
serratulae Thuem.	Serratula sp.	DAOM 78634 = Thuem., Myc. Univ. 2140 in DAOM [Isotype]
	Asteraceae/Cichorieae	
agoseridis Parmelee & Savile	Agoseris aurantiaca (Hook.) Greene	DAOM 155966 as P. hieracii, Calder 14003 et al. [Holotype]
butleri Syd.	Launaea asplenifolia Hook. f.	DAOM 77233 = Syd., Fungi exot. exs. 155 in DAOM [Topotype]
fraseri Arth.	Hieracium scabrum Michx.	DAOM 12795, Fraser [Isotype]
harknessii Vize var. harknessi	Zygodesmia spinosa Nutt.	Ellis., N. Am. Fungi 1446 in DAOM [Neotype]
var. stephanomeriae (Syd.) Parmelee (P. stephanomeria)	Stephanomeria cichoriaea A. Gray	DAOM 108396, McClatachy, Pasadena, Cal., [Isotype of var.]
insperata Jacks.	Prenanthes alta (Hook.) D. Dietr. as Nabalus hastatus	DAOM 23038 ex. Herb. Jacks. 3265 [Isotype]

Puccinia cont'd.	**Asteraceae/Cichorieae cont'd.**	
minussensis Thuem.	Lactuca sibirica (Less.) Benth.	Thuem., Myco. Univ. 1430 in DAOM **[Isotype]**
orbicula Pk. & Clint.	Prenanthes sp. as Nabalus	DAOM 172283 (slide only) ex PUR 34803 [probable **Type**]
pinaropappi Syd.	Pinaropappus roseas (Less.) Less.	Barth., F. Col. 2460 in DAOM **[Isotype]**
suksdorfii Ell. & Ev.	Agoseris sp. as Troximon	DAOM 20054 (slide only) ex NYS **[Syntype]**
troximontis Pk.	Agoseris sp. as Troximon	DAOM 20049 (notes only), ex NYS and DAOM 118942 (slide only) ex PUR 38165, both same date, location & coll. M.E. Jones [part of **Type**]
	Asteraceae/Eupatorieae	
basiporula Jacks. & Holw.	Eupatorium mairetianum Robins.	DAOM 108611, Holw. 98 **[Type** coll'n.]
espinosarum Diet. & Holw.	Eupatorium espinosarum A. Gray	DAOM 77634 and Barth., N. Am. Ured. 1241 in DAOM **[Isotypes]**
inanipes Diet. & Holw.	Eupatorium brevipes DC.	Barth., N. Am. Ured. 150 in DAOM **[Isotype]**
kuhniae Schw. var. robusta Cumm. et al.	Brickellia lemmonii A. Gray	DAOM 106579, Cumm. 61-185 **[Paratype** of var.]
mikanae Jacks. & Holw.	Mikania buddleiaefolia DC.	DAOM 78098, Holw. 1015 **[Isotype** of var.]

Puccinia cont'd.	**Asteraceae/Eupatorieae cont'd.**	
obeisiseptata Cumm. et al.	Eupatorium deltoideum Jacq.	DAOM 108893, Holw. 5202 [**Paratype**] and Barth., N. Am. Ured. 57 in DAOM [**Isotype**] as P. rosea
pachyspora Diet.	Eupatorium oblongifolium Bak.	DAOM 78225, Ule (Herb. Bras. 1684) [part of **Type**]
piqueriae Jacks. & Holw.	Piqueria peruviana (Gmel.) Rob.	DAOM 78325, Holw. 808 [**Isotype**]
praemorsa Diet. & Holw.	Brickellia veronicaefolia A. Gray	DAOM 108988, Holw. 3686 [ex **Type**]
solidpes Jacks. & Holw.	Eupatorium tubuliflorum Benth.	DAOM 108736, Holw. 557 [**Isotype**]
	Asteraceae/Helenieae	
eriophyllii Jacks.	Eriophyllum leucophyllum (DC.) Rydb.	DAOM 77628, Jacks. 3083 [**Paratype**]
	Asteraceae/Heliantheae	
abramsii Parmelee	Geraea viscida (A. Gray) Blake	DAOM 118911 (slide only), Abrams 3633 ex PUR 36727 [from **Holotype**]
absicca Jacks. & Holw.	Zexmenia costaricensis (Polak) Blake	DAOM 76595, Holw. 239 [**Isotype**]
abrupta Diet. & Holw.	Viguiera helianthoides HBK.	Barth., N. Am. Ured. 118 in DAOM [**Isotype**]

Puccinia cont'd.	**Asteraceae/Heliantheae cont'd.**	
var. partheniicola Parmelee	Parthenium hysterophorus L.	DAOM 78241, Holw. 349 [Type of P. parthenii (Speg.) Arth.]
additicia Jacks. & Holw. (= P. electrae)	Coreopsis mexicana (DC.) Hemsl.	DAOM 76982, Holw. 52 [ex Type]
aemulans P. & H. Syd. (= P. enceliae)	Viguiera multiflora (Nutt.) Blake	DAOM 124906 (slide only) ex PUR 33917 [part of Type]
affinis Syd.	Verbesina trilobata Robins. & Greenm.	DAOM 118907, Syd., Ured. 1514 in DAOM [Isotype]
var. triporosa Parmelee	Verbesina montanoifolia Robins. & Greenm.	DAOM 118912 (slide only) ex PUR 34573 [from Type]
axiniphylii Arth.	Axiniphyllum tomentosum Benth.	DAOM 124871 (slide only), Holw. 3710 = Barth., N. Am. Ured. 1529 in DAOM [Isotype]
balsamorhizae Pk.	Balsamorhiza macrophylla Nutt.	DAOM 124875 & 124904 (slides only) ex PUR 37548 & 37610 respect. [Lectotype]
batesiana Arth.	Heliopsis helianthoides (L.) Sweet var. scabra (Dumal) Fern.	DAOM 124866 (slide only) ex PUR 36442 [Holotype]
boliviana Jacks. & Holw.	Oyedaea boliviana Britt.	DAOM 77210, Holw. 676 [Isotype]

Puccinia cont'd.	**Asteraceae/Heliantheae cont'd.**	
brachytela Syd.	Otopappus verbesinoides Benth.	DAOM 124877 = Syd., F. Exot. Exs. 565 **[Isotype]**
caborcensis Parmelee	Ambrosia deltoidea (Torr.) Payne	DAOM 126931 ex PUR 61938 **[Isotype]**
calanticariae Parmelee	Viguiera buddleiaeformis Benth. & Hook. f. ex Hemsl.	DAOM 118908, Barth., N. Am. Ured. 1215 in DAOM **[Isotype]**
caleae Arth.	Calea urticaefoliae (Mill.) DC.	DAOM 124873 ex PUR 33940, Holw. 5126 **[Type]** and Barth., N. Am. Ured. 930 in DAOM **[Isotype]**
var. cuernavacae Parmelee	Calea zacatechichi Schlecht.	DAOM 118913 (slide only) ex PUR 33956, Holw. 5301 [**Isotype** of var.]
chloracae Parmelee	Viguiera stenoloba Blake	DAOM 144826 ex PUR 63361, Cumm. 61-311 [part of **Type**]
cognata Syd. var. cognata	Verbesina virginica L.	DAOM 124880 (slide only) ex PUR 34556, Long 50 [**Isotype** of species]
var. echinulata Parmelee	Verbesina turbacensis HBK.	DAOM 118910 (photo only) ex PUR 49983 [**Isotype** of var.]
var. fraseri Parmelee	Verbesina fraseri Hemsl.	DAOM 118909 (slide only) ex PUR 48969 [**Holotype** of var.]

Puccinia cont'd.	**Asteraceae/Heliantheae cont'd.**	
desmanthodii Diet. & Holw.	Desmanthodium ovatum Benth.	DAOM 124844 (slide only) ex PUR 36481, Holw. 3365 and Barth., N. Am. Ured. 1540 in DAOM [Isotypes]
electrae Diet. & Holw. var. electrae	Coreopsis mutica DC. as C. galeotti	DAOM 124878 (slide only) ex PUR 42624, Holw. 3664 and Barth., N. Am. Ured. 1439 in DAOM [Isotypes]
var. depressiporosa Parmelee	Zexmenia brevifolia A. Gray	DAOM 115964, 11487 = PUR 58913 and 63362 respect., Cumm. 61-415 [Isotypes]
var. robusta Parmelee	Zexmenia brevifolia A. Gray	DAOM 116670 (slide only) ex PUR 49948 [Isotype]
enceliae Diet. & Holw. var. enceliae	Simsia foetida (Cav.) Blake as Encelia mexicana	DAOM 124898 (slide only) ex PUR 37630 and Barth., N. Am. Ured. 1240 in DAOM [Isotypes]
var. aemulans (Syd.) Parmelee (P. aemulans)	Viguiera multiflora (Nutt.) Blake as Gymnolomia m.	DAOM 124906 (slide only) ex PUR 33917 [Type]; Syd., Ured. 1921, 1922, 1923 in DAOM [Paratypes] as P. gymnolomiae Diet. & Holw.
ferox Diet. & Holw.	Verbesina diversifolia DC.	DAOM 108921, Holw. 3704 [Isotype]
franseriae Syd.	Ambrosia ambrosioides (Cav.) Payne as Franseria a.	DAOM 126968 = Griff., West Am. Fungi 257 [Type] in PUR and DAOM as P. tanaceti

Puccinia cont'd.	**Asteraceae/Heliantheae cont'd.**	
ghiesbrechtii Parmelee	Zexmenia ghiesbrechtii A. Gray	DAOM 116680, Cumm. 63-710 **[Isotype]**
gilliesiana Lindq. (= P. enceliae var. aemulans)	Viguiera gilliesii Hieron.	DAOM 134979 ex LPS 31788, A. Ruis Leal 22704 **[Type]**
globulifera Arth.	Otopappus epalaceus Hemsl.	DAOM 124874 (slide only) ex PUR 42612, Holw. 5313 **[Isotype]**
guardiolae Diet. & Holw.	Guardiola mexicana Humb. & Bonpl.	DAOM 108926, Holw. 3513 **[Isotype]**
guatemalenses Parmelee	Zexmenia frutescens (Mill.) Blake	DAOM 118914 (slide only) ex PUR 37621, Holw. 601 **[Holotype]**
gymnolomiae Arth.	Gymnolomia subflexuosa Benth. & Hook.	DAOM 124860 (slide only) ex PUR 33934, Holw. 3645 **[Isotype]**
helianthellae Arth.	Helianthella californica A. Gray	DAOM 124856 (slide only) ex PUR 34465, Heller 7072 **[Type]**
helianthi Schw.	Helianthus tuberosus L.	DAOM 124850 (slide only) ex PUR 34413 from Syn. Fung. in Am. bor. no. 2923 in PH **[Lectotype]**
holwayula Jacks.	Oyedaea acuminata (Benth.) Benth. & Hook.	DAOM 77842 and 108676, Holw. 356 = PUR 34498 **[Isotypes]**
inaudita Jacks. & Holw.	Zexmenia leucactis Blake	DAOM 108683, Holw. 693 [ex Type]

Puccinia cont'd.	**Asteraceae/Heliantheae cont'd.**	
intermixta Pk.	Iva axillaris Pursh	DAOM 126965 (slide only) ex PUR 36364 [part of Type]
invelata Jacks.	Verbesina montanoifolia Robins. & Greenm.	DAOM 124881 (slide only) ex PUR 34568, Holw. 3606-7 [Type]
iostephanes Diet. & Holw.	Iostephane heterophylla Benth.	DAOM 124847 (slide only) ex PUR 42626, Holw. 3543= N. Am. Ured. 455, = F. Col. 3849 [Isotypes]
irregularis Diet.	Verbesina subcordata DC.	DAOM 124879 (slide only) ex PUR F8315, Ule 1691 [Type material]
massalis Arth.	Helianthus ciliaris DC.	DAOM 124861 (slide only) ex PUR 34457 [ex Type]
melampodii Diet. & Holw.	Melampodium divaricatum (Rich.) DC.	DAOM 124854 (slide only) ex PUR 42095 [Type material]
mirifica Diet. & Holw.	Borrichia frutescens (L.) DC.	DAOM 124862 (slide only) ex PUR 37537 [ex Type]
nanomitra P. & H. Syd. (= P. iostephanes)	Viguiera dentata (Cav.) Spreng.	DAOM 124905 (slide only) ex PUR 42615 [Type]
noccae Arth.	Lagascea decipiens Hemsl. as Nocca d.	DAOM 108971, Holw. 5122 [Isotype]

Puccinia cont'd.	Asteraceae/Heliantheae cont'd.	
notopterae Arth.	Notoptera hirsuta (Sw.) Urb.	DAOM 124870 (slide only) ex PUR 41996, Holw. 226 [Type material]
nuda Ell. & Ev.	?Madia sp. as Arnica foliosa	DAOM 216104 (slide only) ex PUR 42589 [Type specimen ex FH]
oblata Mains	?Otapappus curviflorus (R.Br.) Hemsl.	DAOM 124900 (slide only) ex MICH, Deam 89A [Type]
opaca Diet. & Holw. (= P. zexmeniae)	Zexmenia ceanothifolia (Wild.) Schultz	DAOM 124899 ex PUR 34475 (slide only), Holw. s.n. [Type]
ordinata Jacks. & Holw. (= P. melampodii)	Calea insignis Blake	DAOM 108711, Holw. 817 and 124907 (slide only) ex PUR 42004 [Syntype]
otoppi P. & H. Syd.	Otopappus alternifolius Robins.	DAOM 124876 (slide only) ex PUR 42600, Pringle [Isotype]
otopappicola Jϕrst.	Otopappus curviflorus (R.Br.) Hemsl. as Notoptera brevipes	DAOM 124901 (slide only) ex PUR 36485, Holw. 846 [Type material]
parthenices Jacks.	Parthenice mollis A. Gray	DAOM 124851 (slide only) ex PUR 42590, Thornber 1029 [Type]
parthenii Arth.	Parthenium argentatum A. Gray	DAOM 124902 (slide only) ex PUR 42602 [Type]
polymniae Jacks. & Holw.	Polymnia glabrata DC.	DAOM 78386, Holw. 558 [Type]

Puccinia cont'd.	**Asteraceae/Heliantheae cont'd.**	
praetermissa Parmelee	Lagascea decipiens Hemsl.	DAOM 115970 ex PUR, Cumm. 61-18 **[Isotype]**
proba Jacks. & Holw.	Zexmenia frutescens (Mill.) Blake	DAOM 124846 (slide only) ex PUR 37622, Holw. 247 **[Lectotype]**
punctoidea P. & H. Syd.	Viguiera pringlei Robins. & Greenm.	DAOM 124843 (slide only) ex PUR ex S, Pringle **[Type]**
rudbeckiae Barth.	Rudbeckia maxima Nutt.	Barth., N. Am. Ured. 2862 in DAOM **[Isotype]**
schileana Speg.	Verbesina encelioides (Cav.) B. & H.	DAOM 134973 ex LPS 4896 **[Isotype]**
semota Jacks. & Holw.	Hymenostephium cordatum (H. & A.) Blake as Gymnolomia subflexuosa	DAOM 124852 (slide only) ex PUR, Holw. 146 **[Type]**
silphii Schw.	Silphium trifoliatum L.	DAOM 124867 (slide only) ex PUR 42074 ex PH **[Type]**
sonorae Parmelee	Ambrosia cordifolia (A. Gray) Payne	DAOM 126932, Cumm. 63-762 **[Isotype]**
splendens Vize	Hymenoclea sp.	DAOM 126966 (slide only) ex PUR, Harkness [part of **Type]**
steiractiniae Jacks. & Holw.	Steiractinia rosei Blake	DAOM 78724, Holw. 832 **[Isotype]**
subaquila Jack & Holw.	Wedelia holwayi Blake	DAOM 78738, Holw. 376 **[Isotype]**

Puccinia cont'd.	**Asteraceae/Heliantheae cont'd.**	
subglobosa Diet. & Holw.	Rhysolepis palmeri (A. Gray) Blake	DAOM 78742, Holw. 3488 **[Isotype]**
tithoniae Diet. & Holw. (= P. enceliae var. enceliae)	Tithonia tabaeformis Cass. as T. tubiflora ?ined.	DAOM 124908 (photomicrographs and slide only) ex PUR 42566, Holw. **[Isotype]**
turgidipes Jacks.	Viguiera deltoidea A. Gray	DAOM 124868 (slide only) ex PUR 42550, Gooding 48 [Part of **Type**]
vaga Jacks.	Verbesina sp.	DAOM 124869 (slide only) ex PUR 42610, Holw. [ex **Type**]
verbesinae Schw.	Verbesina occidentalis (L.) Wats.	DAOM 124855 and ex PUR 34508 (slide only) = Barth., F. Col. 2969 in DAOM **[Neotype]**
wedeliae E. Mayor (= P. melampodii)	Wedelia trichostephia DC.	DAOM 78905, Mayor [? **Syntype**]
wedeliicola Jacks. & Holw.	Wedelia trichostephia DC.	DAOM 78906, Holw. 1822 **[Isotype]**
xanthii Schw.	Xanthium sp.	DAOM 126967 (slide only) ex PUR 41291 ex PH [part of **Type**]
ximenesiae Long	Verbesina encelioides (Cav.) B. & H.	DAOM 124859 (slide only) ex PUR 34614, Long 65 [**Type**]

Puccinia cont'd.	**Asteraceae/Heliantheae cont'd.**	
zaluzeniae Arth.	Zaluzenia asperrima Schz.	DAOM 109037, Holw. 5347 [part of **Type**]
zexmeniae Diet. & Holw.	Zexmenia podocephala A. Gray	DAOM 124872 (slide only) ex S **[Lectotype]**
	Asteraceae/Mutiseae	
defecta Jacks. & Holw.	Jungia rugosa Less.	DAOM 77543, Holw. 994 **[Isotype]**
subita Jacks. & Holw.	Mutisa sagittifolia Blake	DAOM 78744, Holw. 941 **[Isotype]**
trixitis Arth.	Trixis frutescens P. Br.	DAOM 108745, Holw. 108, Solola Guat. **[Lectotype]** non Holw. 71, Antigua Guat.
	Asteraceae/Senecioneae	
egmontensis Cunn.	Celmisia glandulosa Hook.	DAOM 77596, Reid & Foy [**Type** collection]
majuscula Jacks. & Holw.	Senecio sp.	DAOM 78036, Holw. 627 **[Isotype]**
procerula Jacks. & Holw.	Senecio pellucidinervis Sch. Bip.	DAOM 78425, Holw. 1865 **[Isotype]**
proluviosa Jacks. & Holw.	Senecio pellucidinervis Sch. Bip.	DAOM 78426, Holw. 1767 **[Isotype]**
schistocarphae Jacks. & Holw.	Schistocarpha platyphylla Greenm.	DAOM 108728, Holw. 42 **[Isotype]**

Puccinia cont'd.	**Asteraceae/Senecioneae cont'd.**	
senecioicola Arth.	Senecio angulifolius DC.	DAOM 109007, Holw. 5254 [Paratype]
senecionis Lib.	Senecio fuchsii Gmel.	DAOM 116435 ex Libert, Plantae Crypt. Ard. I:92 in DAOM [Isotype]
	Asteraceae/Vernonieae	
agnitionalis Jacks. & Holw.	Vernonia diffusa Less.	DAOM 76994, Holw. 1184 [Isotype]
allandabilis Jacks. & Holw.	Vernonia argyrotrichia Sch. Bip.	DAOM 77005, Holw. 1199 [Isotype]
decpecanea Jacks. & Holw.	Vernonia sp.	DAOM 77550, Holw. 1962 [Isotype]
discreta Jacks & Holw.	Vernonia deppiana Less.	DAOM 77568 & 108644, Holw. 260 [Isotype]
fausta Jacks. & Holw.	Vernonia macrophylla Less.	DAOM 77685, Holw. 1216 [Isotype]
fundata Jacks. & Holw.	Vernonia sp.	DAOM 77700, Holw. 1261 [Paratype]
idonea Jacks. & Holw.	Vernonia triflosculosa HBK.	DAOM 108678, Holw. 481 [Paratype]
illatabilis Jacks. & Holw.	Vernonia scirpioides Pers.	DAOM 77866, Holw. 729 [Isotype]
impetrabilis Jacks. & Holw.	Vernonia sp.	DAOM 77870, Holw. 1265 [Isotype]

Puccinia cont'd.	**Asteraceae/Vernonieae cont'd.**	
improvisia Jacks. & Holw.	Vernonia subsquarrosa DC.	DAOM 77883, Holw. 1064 **[Isotype]**
inaequata Jacks. & Holw.	Vernonia patens HBK.	DAOM 214851, Holw. 851 **[Paratype]**
kuntzii Jacks. & Holw.	Vernonia kuntzii Hieron.	DAOM 77948, Kuntze **[Isotype]**
notha Jacks. & Holw.	Vernonia linocarpa DC.	DAOM 108706, Holw. 148 **[Isotype]**
pertrita Jacks & Holw.	Vernonia lessengioides Sch. Bip.	DAOM 78278, Holw. 1901 **[Isotype]**
pestibilis Jacks. & Holw.	Vernonia oppositifolia Less.	DAOM 78280, Holw. 1233 **[Isotype]**
pinguis Diet.	Vernonia platensis Less.	DAOM 78319, Ule ex Herb. Bras. 1692 **[Isotype]**
praealta Jacks. & Holw.	Vernonia triflosculosa HBK.	DAOM 108719, Holw. 510 **[Isotype]**
rata Jacks. & Holw.	Vernonia leiocarpa DC.	DAOM 108726, Holw. 490 **[Isotype]**
vanillosmopsidis Jacks. & Holw.	Vanillosmopsis ergthropapa (DC.) Sch. Bip.	DAOM 78848, Holw. 1420 **[Isotype]**
veniabilis Jacks. & Holw.	Vernonia sp.	DAOM 78852, Holw. 1189 **[Isotype]**
	Berberidaceae	
berberis-trifoliae Diet.	Berberis trifolia Schult.	DAOM 77201, Holw. 3570 **[Isotype]**
mahoniae Cumm.	Mahonia gracilis (Hartw.) Fedde	DAOM 129591, Cummins 69-72 **[Topotype]**

Puccinia cont'd.	**Bignoniaceae**	
depallens Arth. & Holw. in Arth. (= Prospodium d.)	Pithecoctenium muricatum DC.	DAOM 77549, Holw. 365 [Isotype]
exitiosa Syd. & Holw. (= Prospodium transformans (Ell. & Ev.) Cumm.)	Tecoma mollis Humb. & Bonpl.	DAOM 77646, Holw. s.n. = Barth., N. Am. Ured. 140 in DAOM [Isotype]
	Boraginaceae	
gilva Arth. & Holw. in Arth.	Heliotropium physocalycinum D. Smith	DAOM 108661, Holw. 626 [Paratype]
tournefortiae Jacks. & Holw.	Tournefortia fuliginosa HBK.	DAOM 78797, Holw. 589 [Isotype]
	Brassicaceae	
arabicola Ell. & Ev.	Arabis sp.	DAOM 215974, Fletcher as Can. Fungi 157 [Type]
codyi Savile	Smelowskia borealis (Greene) Drury & Roll.	DAOM 117852, Cody 17118 [Holotype]
cruciferarum Rud. ssp. borealis Savile	Cardamine bellidifolia L.	DAOM 46935, Calder 15114 et al. [Holotype of ssp.]

Puccinia cont'd.	**Brassicaceae cont'd.**	
ssp. nearctica Savile & Parmelee	Cardamine bellidifolia L.	DAOM 91450, Parmelee 1119 [**Holotype** of ssp.]
ssp. wyomingensis Savile	Cardamine cordifolia A. Gray	DAOM 61247 = Solheim, Myco. Saxi. Exs. 652 in DAOM [**Holotype** of ssp.]
drabicola Savile	Draba incerta Payson	DAOM 144984, Calder 11727 & Savile [**Holotype**]
thelypodii Cumm.	Thelypodium lasiophyllum (Hook. & Arn.) E. Greene	DAOM 78778, Parks 6154 [**Isotype**]
	Capparidaceae	
cleomis Jacks. & Holw.	Cleome gigantea L.	DAOM 77405, Holw. 634 [**Isotype**]
	Caryophyllaceae	
detonsa Arth. & Holw.	Stellaria ovata Willd.	DAOM 108642, Holw. 252 [**Isotype**]
dianthi-japonica P. Henn.	Dianthus japonicus Thunb.	DAOM 77552, Yoshinaga [**Isotype**]
gypsophila-repentis Mayor & Cruchet	Gypsophila repens L.	Vest., Micro. rariores sel. 1571 in DAOM [**Isotype**]
	Convolvulaceae	
distinguenda Jacks. & Holw.	Ipomoea fistulosa Mart.	DAOM 77574, Holw. 794 [**Isotype**]

Puccinia cont'd.	**Convolvulaceae cont'd.**	
insignis Holw.	Ipomoea walcottiana Rose	DAOM 108951, Holw. s.n. [Isotype]
megalospora (Orton) Arth. & Johnst. (Allodus m.)	Ipomoea murmucoides R. & S.	DAOM 108963, Holw. 5370 [Paratype]
nocticolor Holw.	Ipomoea intropilosa Rose	DAOM 108973, Holw. 5345 [Paratype]
	Cornaceae	
porphyrogenita Curt.	Cornus candensis L.	Thuem., Myco. Univ. 545 in DAOM, Peck [Isotype]
	Cucurbitaceae	
anguriae Arth. & Cumm.	Anguria sp.	DAOM 77051, Rose 20704 [Isotype]
	Cyperaceae	
antioquiensis Mayor	Cyperus diffusus Vahl	DAOM 77084, Mayor [Isotype]
caricis-japonicae Diet.	Carex japonica Thunb. var. chlorostachys	DAOM 77309, Yoshinaga [Isotype]
caricis-shepherdiae J.J. Davis	Carex eburnea Boott	DAOM 90775, Davis 924 [?Isotype]
congdonii Savile	Scirpus congdonii Britt.	Cal. Fungi 507 in DAOM [Holotype]

Puccinia cont'd.	**Cyperaceae cont'd.**	
cyperi Arth.	Carex schweinitzii Torr.	Barth., N. Am. Ured. 838 in DAOM [Isotype]
eriophorii Thuem. var. apargidii Savile	Eriphorum polystachion L.	DAOM 139328, Calder 23483 et al. [Type of var.]
fimbristylidis Arth.	Fimbristylis holwayana Fern.	DAOM 108992, Holw. 3443 [Paratype]
flavo-virens Jacks. & Holw.	Cyperus ferax L.C. Rich.	DAOM 77693, Holw. 908 [Isotype]
gahniae Dingley	Gahnia sp.	DAOM 193103 ex PDD 30770 [Paratype]
hyalina Diet.	Carex sp.	DAOM 77848, Yoshinaga [Isotype]
juncellii Diet.	Juncellus serotinus (Rott.) Clarker	DAOM 77935, Yoshinaga [Isotype]
karelica Tranz. ssp. laurentia Savile	Carex magellanica Lam.	DAOM 105903, Savile 2969B [Type of ssp.]
nociva Jacks. & Holw.	Cyperus meyerianus Kunth	DAOM 78158, Holw. 504 [Isotype]
oblongula Jacks. & Holw.	Rhynchospora sp.	DAOM 78168, Holw. 885 [Isotype]
obvoluta Arth.	Cyperus ferax L.C. Rich.	DAOM 78816, Holw. 1414 [Isotype]
osoyoosenis Savile	Scirpus americanus Pers.	DAOM 139216, Calder 11507 et al. [Holotype]
puritanica Cumm.	Carex pensylvanica Lam.	DAOM 7039 (=78469), Seymour [Isotype]

Puccinia cont'd.	**Dilleniaceae**	
vergrandis Arth.	Saurauja pauciserrata Hemsl.	DAOM 108614, Holw. 820 [Isotype]
	Elaeaganacaeae	
elaeagni Yoshin. ex Diet.	Elaeagnus pungens Thunb.	DAOM 33326 (=77597), Yoshinaga [Isotype]
	Euphorbiaceae	
actinostemonis Jacks. & Holw.	Actinostemon sp.	DAOM 76980, Holw. 1600 [Isotype]
festata Jacks. & Holw.	Euphorbia sp.	DAOM 77687, Holw. 990 [Isotype]
velata (Ell. & Ev.) Arth. (Uredo v.)	Euphorbia cordata Meyen	DAOM 145948, Heller [Isotype]
	Fabaceae	
paroselae Cumm.	Parosela mollis (Benth.) Hell.	DAOM 57344, Parks & Jordon 6430 [Isotype]
	Gentianaceae	
haleniae Arth. & Holw.	Halenia deflexa (Sm.) Griseb.	Barth., N. Am. Ured. 145 in DAOM [Isotype]

Puccinia cont'd.	**Gentianaceae cont'd.**	
lisianthi Jacks. & Holw.	Lisianthus elegans Mart. var. pedunculatus Cham. & Schl.	DAOM 77998, Holw. 1372 [Isotype]
	Geraniaceae	
calliquensis Neger	Geranium berterianum Colla	DAOM 77427, Neger [Isotype]
distenta Jacks. & Holw.	Geranium ochensii Phil.	DAOM 77569, Holw. 19 [Isotype]
	Grossulariaceae	
parkerae Diet. & Holw.	Ribes lacustre (Pers.) Poir.	Ell. & Ev., F. Col. 753; Ell. & Ev., N. Am. Fungi 3242; Barth., N. Am. Ured. 52 all in DAOM. All labels match data in original description [Isotype]
ribesii-japonica P. Henn.	Ribes japonicum Maxim.	DAOM 78511, Yoshinaga [Isotype]
	Hamamelidaceae	
corylopsidis Cumm.	Corylopsis sp.	DAOM 43796, Cheo 1993 [Isotype]
sakamotoi Hirats. f. & Yosh.	Distylium racemosum Sieb. & Zucc.	DAOM 32893, Sakatmoto ex HH [Isotype]

Puccinia cont'd.	**Lamiaceae**	
aenigmatica Jacks. & Holw.	Salvia kuntzeana Briq.	DAOM 76990, Holw. 358 **[Isotype]**
albicera Jacks. & Holw.	Salvia derasa Benth.	DAOM 76999, Holw. 889 **[Isotype]**
amplifica Jacks. & Holw.	Hyptis eriocephala Benth.	DAOM 77024, Holw. 881 **[Syntype]**
calvatica Jacks. & Holw.	Hyptis carpinifolia Benth.	DAOM 77365, Holw. 1325 **[Isotype]**
conturbata Jacks. & Holw.	Salvia sp.	DAOM 77461, Holw. 842 **[Isotype]**
distorta Holw.	Hyptis pectinata Poir.	DAOM 108906, Holw. 5035 **[Paratype]**
fidulis Arth.	Hyptis stellutata Benth.	DAOM 77690, Pringle = Rel. Farl. 755 **[Isotype]**
fuscata Arth. & Holw.	Cunila leucantha Benth.	DAOM 108656, Holw. 785 **[Isotype]**
impedita Mains & Holw. in Arth.	Salvia hyptoides Mart. & Gal.	DAOM 108680, Holw. 297 **[Isotype]**
perfuncta Jacks. & Holw.	Hyptis fasciculata Benth.	DAOM 78257, Holw. 1527 **[Isotype]**
perscita Jacks. & Holw.	Hyptis odorata Benth.	DAOM 78270, Holw. 669 **[Isotype]**
porphyretica Jacks. & Holw.	Salvia pseudoavicularis Briq. and S. cridgesii Burtton	DAOM 78389, Holw. 527 and DAOM 78388, Holw. 329 **[Paratypes]**
sana Jacks. & Holw.	Salvia leucocephala HBK.	DAOM 78584, Holw. 835 **[Syntype]**

Puccinia cont'd.	**Lamiaceae cont'd.**	
sphacelicola Jacks. & Holw.	Sphacele paniculata Benth.	DAOM 78713, Holw. 865 [Isotype]
	Lauraceae	
cera Cumm.	Benzoin sp.	DAOM 43801, Cheo 2640 [Isotype]
cinnamomicola Cumm.	Cinnamomum sp.	DAOM 43799, Cheo 2557 [Isotype]
coronospora Cumm.	Lindera sp.	DAOM 43797, Cheo 868 [Isotype]
lauricola Cumm.	Lindera strychnifolia F. Vill.	DAOM 43786, Cheo 1724 [Isotype]
machii Cumm.	Machilus sp.	DAOM 43783, Cheo 1976 [Isotype]
scimitriformis Cumm.	Persea sp.	DAOM 43764, Cheo 2568 [Isotype]
seposita Cumm.	Benzoin sp.	DAOM 43763, Cheo 2817 [Isotype]
takakumensis (Hirats. f.) Hirats. f. (Xenostele t.)	Actinodaphne longifolia Nakai	DAOM 32895, Tatsumo [Isotype]
	Liliaceae	
okudairai Hirats. f. & Yosh.	Scilla japonica Bak.	DAOM 33520, Okudaira [Isotype]

Puccinia cont'd.	**Loranthaceae**	
loranthicola McAlp.	Loranthus celastroides Sieb.	DAOM 78012, Robinson [Isotype]
	Lythraceae	
cupheae Holw.	Cuphea sp.	DAOM 108900, Holw. 3750 [Isotype]
	Malpighiaceae	
inrecta Jacks. & Holw.	Banisteria campestris Juss.	DAOM 77897, Holw. 1734 [Isotype]
picturata Jacks. & Holw.	Heteropteris sp.	DAOM 78310, Holw. 1401 [Isotype]
	Malvaceae	
plagianthi McAlp.	Plagianthus sidoides Hook.	DAOM 78327, Rodway [Isotype]
	Melanthaceae	
bessei D. Cruchet	Lloydia serotina (L.) Reichenb.	DAOM 77202 (= 83111), Cruchet [Isotype]
grumosa Syd. & Holw.	Zygadenus elegans Pursh	DAOM 191808, Holw. s.n. [Isotype]
kukkonensis Savile	Lloydia serotina (L.) Reichenb.	DAOM 74672, Kukkonen 581 & Calder [Holotype]

Puccinia cont'd.	**Poaceae**	
aegopogonis Arth. & Holw.	Aegopogonis cenchroides H. & B.	DAOM 108599, Holw. 650 **[Paratype]**
amphigena Diet.	Calamovilfa longifolia (Hook.) Hack.	DAOM 108299, Arth. **[Isotype]**
aristidae Tracy var. chaetaiae Cumm. & Husain	Aristida adscenionis L.	DAOM 114193, Cumm. 61-230 **[Isotype** of var.**]**
asprellae-japonicae Hara	Hystrix hackeli Hara	DAOM 185830 ex PUR 15634 (slide only), Hara **[Isotype]**
burnettii Griffiths	Stipa comata Trin. & Rupr.	Griff., West Am. Fungi 387 in DAOM **[Isotype]**
chisosensis Cumm.	Piptochaetium fimbriatum (HBK.) Hitchc.	DAOM 106498, Cumm. 62-388 **[Isotype]**
cryptandri Ell. & Ev. var. luxurians (Arth.) Cumm. & Greene (P. tosta luxurians)	Sporobolus airoides Torr.	Griff., West Am. Fungi 304 in DAOM **[Isotype]**
cymbopogonis Mass.	Cymbopogon citratus (DC.) Stapf.	DAOM 77521 **[Syntype]**
ellisiana Thuem.	Andropogonis virginicus L.	Thuem., Myco. Univ. 1336 in DAOM **[Isotype]**
lepturi Hirats. f.	Lepturus repens R.Br.	DAOM 33446, Hirats. f. **[Isotype]**

Puccinia cont'd.	**Poaceae cont'd.**	
moliniicola Cumm. (= P. diplachnicola Diet. fide Cumm., 1971)	Molinia sp.	DAOM 43777, Cheo 1484 [Isotype]
morigera Cumm.	Eragrostis sp.	DAOM 43776, Cheo 385 [Isotype]
neocoronata Greene & Cumm.	Stipa pringlei Scribn.	DAOM 61013, Solh. 2453 = Solh., Myc. Sax. Exs. 589 [Isotype]
oahuensis Ell. & Ev.	Panicum pruriens Trin.	DAOM 145947, Heller no. 1976 [Isotype]
paradoxica Ricker	Melica smithii (Porter) Vasey	DAOM 24370, Mains [Topotype]
poae-nemoralis Otth. ssp. hyparctica Savile	Poa hartzii Grand.	DAOM 91201, Savile 4688 [Holotype of ssp.]
polliniae-quadrinervis Diet.	Pollinia quadrinervis Hook.	DAOM 78363, Yoshinga [Isotype]
praegracilis Arth. var. cabotiana Savile	Hierchloe odorata (L.) Beauv.	DAOM 43076, Savile 3291 [Holotype of var.]
var. connersii (Savile) Savile (Puccinia c.)	Valodea atropurpurea (Wahl.) Fr.	DAOM 23446, Savile 729 [Holotype of var.]
var. praegracilis	Agrostis thurberiana Hitch.	DAOM 25493 (notes only) ex PUR 21988 [Type]

Puccinia cont'd.	**Poaceae cont'd.**	
rangiferina Ito	Calamagrostis arundinacea (L.) Roth	DAOM 33594 ex HH, Yamada & Sawada [?Isotype, ?Topotype]
schedonnardi Kell. & Swingle	Schedonnardus paniculatus (Nutt.) Trel. as S. texanus	Ell. & Ev., N. Am. Fungi 2246 in DAOM [Isotype]
setariae Diet. & Holw.	Setaria imberbis Roem. & Schultes.	DAOM 109012, Holw., 20 Sept. 1896 [?Isotype]
scillae-rubrae Cruchet	Festuca rubra L.	DAOM 78607, Cruchet [?Isotype]
scleropogonis Cumm.	Scleropogon brevifolius Phil.	DAOM 106664, Cumm. 62-423 [Isotype]
sonorica Cumm. & Husain var. sonorica	Aristida hamulosa Henr.	DAOM 116097, Cumm. 62-65 [Isotype]
sparganioides Ell. & Barth.	Spartina pectinata Lk. as Carex sparganioides	DAOM 57566 = Ell. & Ev., N. Am. Fungi 3475 in DAOM [Isotype]
substerilis Ell. & Ev. var. substerillis	Stipa viridula Trin. as Chrysopogon sp.	Ell. & Ev., N. Am. Fungi 3141 and F. Col. 548 in DAOM [Isotype]
var. oryzopsidis Greene & Cumm.	Oryzopsis hymenoides Rich.	Bethel, Fungi Col. 5075 in DAOM [Isotype of var.]
substriata Ell. & Barth.	Paspalum setaceum Michx.	Ell. & Ev., N. Am. Fungi 3577, and Barth., F. Col. 1186 in DAOM [Isotypes]
unica Holw. in Arth. & Fromme	Aristida longiramea Presl.	DAOM 109024, Holw. 3020 [Isotype]

Puccinia cont'd.	**Poaceae cont'd.**	
vexans Farl.	Bouteloua curtipendula (Michx.) Torr.	Ell., N. Am. Fungi 1051 in DAOM **[Isotype]**
vilfae Arth. & Holw. var. vilfae	Sporobolus asper (Michx.) Kunth	Ell. & Ev., F. Col. 48 in DAOM **[Isotype]**
var. mexicana Cumm.	Sporobolus buckleyi Vasey	DAOM 116114, Cummins 62-210 [**Isotype** of var.]
virgata Ell. & Ev.	Panicum virgatum L. = Sorghastrum nutans (L.) Nash	Ell. & Ev., N. Am. Fungi 2888 in DAOM **[Isotype]**
	Polemoniaceae	
douglasii Ell. & Ev. var. douglasii	Phlox douglasii Hook.	DAOM ex PUR 36242 (slide & photo only), M.E. Jones [part of **Type**]
var. hoodii Parmelee	Phlox hoodii Benth. as P. glabrata	DAOM 61307, Solh., Myc. Sax. Mont. 244 [**Isotype** of var.]
fragilis Tracy & Gal. var. fragilis	Phlox longifolia Nutt. as Arenaria pungens	DAOM ex PUR 36210 (slide & photo only), Tracy & Evans [ex **Type**]
var. divaricata Parmelee	Phlox divaricata L.	DAOM 62911, Parmelee & Savile [**Holotype** of var.]

Puccinia cont'd.	**Polemoniaceae cont'd.**	
fumosa Holw.	Loeselia glandulosa G. Don.	DAOM ex PUR 32775 (slide & photo only), Holw. 5325 **[Isotype]**
giliae Hark.	Linanthus ciliatus (Benth.) Greene as Gilia c.	DAOM ex PUR 32760, (slide & photo only), Harkness [part of **Type**]
giliicola P. Henn.	Leptodactylon californicum Hook. & Arn. as Gilia c.	Rab. & Paz., Fungi Eur. 4221 in DAOM **[Isotype]**
gulosa Jacks. in Arth.	Polemonium pulcherrimum Hook.	DAOM 4814, Clemens 24 **[Isotype]**
plumbaria Peck	Microsteris gracilis (Hook.) Greene as Collomia g.	DAOM ex PUR 36141 (slides & photo only), Jones [part of **Type**]
polemonii Diet. & Holw. in Diet.	Polemonium coeruleum L.	DAOM ex PUR 40477 (slide & photo only), Sandberg [part of **Type**]
yosemitana Blasdale	Leptodactylon pungens (Torr.) Nutt. as Gilia p.	DAOM ex PUR 36263 (slide & photo only), Blasdale [part of **Type**]
	Polygonaceae	
amphispilusa Diet. & Holw.	Polygonum sp.	DAOM 77023, Nutting [part of **Type**]
benokiyamensis Hirats. f.	Polygonum chinensis L. as Ampelygonium umbellata	DAOM 33257, Taira 436 [part of **Type**]

Puccinia cont'd.	**Polygonaceae cont'd.**	
kweichowana Cumm.	Polygonum campunulatum Hook. f. var. likiangensis	DAOM 43788, Cheo 651 [part of Type]
	Portulaceae	
agnita Arth.	Claytonia megarhiza (A. Gray) Parry	DAOM 46678, Baker, Tracy & Earle 1045 [part of Type]
claytoniicola Cumm.	Claytonia lanceolata Pursh	DAOM 38961 = 60982 = Solh., Myc. Sax. Exs. 541 [Isotype]
marie-wilsonii Clint. var. montiae Savile	Montia sibirica (L.) Howell	Barth., N. Am. Ured. 133 in DAOM [Type]
	Ranunculaceae	
retecta Syd.	Anemone zephra Nels. as A. narcissiflora L.	Griff., West Am. Fungi 328 in DAOM, Shear [Isotype]
treleasiana Paz.	Caltha leptosepala DC.	Rab., Wint. & Pazs., Fungi Europ. 3821 in DAOM [Isotype]
	Rosaceae	
urbanis Savile	Geum calthifolium J.E. Sm.	DAOM 145468, Calder 20360, Parmelee & Taylor [Holotype]

Puccinia cont'd.	**Rubiaceae**	
coccocypseli Jacks. & Holw.	Coccocypselum condalia Pers.	DAOM 77417, Holw. 1777 **[Isotype]**
concumulata Jacks. & Holw.	Galium sp.	DAOM 77434, Holw. 2023 **[Isotype]**
eximia Arth. & Holw.	Galium sp.	DAOM 108652, Holw. 645 **[Paratype]**
	Rutaceae	
eriostemonis McAlp.	Eriostemon myoporoides DC.	DAOM 77629, C. French **[Syntype]**
	Saxifragaceae	
asiatica (Kom.) Syd. (=P. heucherae var. asiatica)	Mitella nuda L.	Jacz., Kom. & Tranz., Fungi Ross. Exs. 163 in DAOM **[Isotype]**
austroberingiana (Savile) Savile ssp. austroberingiana (P. heucherae var. austroberingiana)	Tellima grandiflora (Pursh) Dougl.	Barth., N. Am. Ured. 1450 in DAOM **[part of Type]**

Puccinia cont'd.	**Saxifragaceae cont'd.**	
ssp. saxifragarum Savile	Saxifraga fusca Maxim.	DAOM 33613, Hiratsuka f. [Holotype of ssp.]
fischeri Cruchet & Mayor	Saxifraga biflora All.	DAOM 36461 (slide only), Cruchet & Mayor [ex Type material]
harae Savile	Chrysosplenium axillare Maxim.	DAOM 117205 (slide only), Duthie 13260 [Isotype]
heucherae (Schw.) Diet. var. cordillerana Savile	Saxifraga lyalli Engl. ssp. hultenii Calder & Savile	DAOM 144874, Kukkonen 626 & Calder [Holotype of var.]
var. diffusistriata Savile	Saxifraga tolmei T. & G. var. tolmei	DAOM 143197, Savile 5074 [Holotype of var.]
var. japonica Savile	Saxifraga japonica Boiss.	DAOM 33609, Hiratsuka [Holotype of var.] ex HH
var. meridionalis Savile	Heuchera rubescens Torr.	DAOM 214860, Cumm. 62-23 [Isotype of var.]
var. minor Savile	Mitella nuda L.	DAOM 144876, Kukkonen 443 & Calder [Holotype of var.]
var. saxifragae-micranthae (Barclay) Savile (P. s.-m.)	Saxifraga micrantha Edgeworth	DAOM 44838, Lace [Isotype of var.]

Puccinia cont'd.	**Saxifragaceae cont'd.**	
pazschkie Diet. var. ferruginea Savile	Saxifraga ferruginea Graham	DAOM 59521, Calder 23514A & Taylor [**Holotype** of var.]
var. huteri (Syd.) Savile (P. huteri)	Saxifraga mutata L.	DAOM 36442, Syd., Ured. 1522 in DAOM [**Isotype** of var.]
var. oppositifolia Savile	Saxifraga oppositifolia L.	DAOM 23524, Savile 788 [**Holotype** of var.]
saxifragae Schlecht.		
var. heucherarum Savile	Saxifraga hispida auct.	Griff., West Am. Fungi 272 in DAOM [**Type** of var.]
var. holochloe Savile	Saxifraga cylindrica Dougl. var. septentrionalis R. B. & L.	Barth., N. Am. Ured. 1539 in DAOM [**Type** of var.]
var. longior Savile	Saxifraga cernua L.	DAOM 144919, Kukk. 487 & Calder [**Holotype** of var.]
var. mitellae Savile	Saxifraga stauropetala Piper var. stenopetala (Piper) Rosend.	Solh. & Cumm., Myc. Sax. Exs. 1056 [**Type** of var.]
saxifragae-gei Savile	Saxifraga geum L. var. lapeyroasii Sterub.	DAOM 78251, Unamuno [**Type**]
tottoriensis Hirats. f.	Mitella stylosa Boiss.	DAOM 33644, Hirats. f. [part of **Type**]

Puccinia cont'd.	**Scrophulariaceae**	
albulensis Magn. ssp. cascadensis Savile	Veronica cusickii A. Gray	DAOM 44311, Calder 11599 & Savile **[Holotype** of ssp.]
blutanensis Savile	Pedicularis ?kingii Prain	DAOM 117208, Ludlow et al. 19493 **[Holotype]**
chelonis Diet. & Holw.	Chelonis nemorosa Dougl.	DAOM 108344 = Barth., N. Am. Ured. 128 in DAOM, Suksdorf 455 **[Isotypes]**
clintonii Peck var. albae Savile	Pedicularis racemosa Dougl. ex Hook. ssp. alba Penn.	DAOM 115381 ex PUR 40739, Payson 3697 **[Isotype** of var.]
var. bracteosa Savile	Pedicularis bracteosa Benth.	DAOM 114507, Kukk. 506 & Calder (= Solh. & Cumm., Myc. Sax. Exs. 1241) **[Holotype & Isotypes]**
var. clintonii	Pedicularis canadensis L.	DAOM 115377 (slide only), Clinton ex PUR 40735 **[Isotype]**
var. groenlandicae Savile	Pedicularis groenlandica Retz.	DAOM 61233, Cumm. 56-431 (= Solh. & Cumm., Myc. Sax. Exs. 746) **[Isotype** of var.]
var. ornithorhyncae Savile	Pedicularis ornithorhynca Benth. & Hook.	DAOM 225437, Calder 20366 et al. **[Holotype** of var.]
var. racemosa Savile	Pedicularis racemosa Dougl. ex Hook. ssp. racemosa	DAOM 115832 (slide only), Barss 2544 ex PUR 40740 **[Isotype** of var.]

Puccinia cont'd.	**Scrophulariaceae cont'd.**	
var. sylvaticae Savile	Pedicularis sylvatica L.	DAOM 115378, Green 21/52 [Type of var.]
confraga Arth. & Cumm.	Keckiella antirrhinoides (Benth.) Straw ssp. microphylla (A. Gray) Straw	DAOM 115429 (slide only), Gooding ex PUR 36297 [Type]
dasantherae Savile	Penstemon ellipticus Coult. & Fisch.	DAOM 115394 (slide only), Standley 16759 ex PUR 36305 [Type]
gymnandrae Tranz. ssp. alascensis Savile	Lagotis minor (Willd.) Standl.	DAOM 14773, Anderson 3929R ex PUR (slide only) [part of Type of ssp.]
ssp. camschatcensis Savile	Lagotis glauca Gaertn.	DAOM 147777, Komarov ex BPI [Isotype of ssp.]
ssp. gymnandrae Tranz	Lagotis minor (Wild.) Standl. as Gymnandra m.	DAOM 117494 (slide only), Kusnezor ex LE [Type]
ssp. yunnansis Savile	Lagotis yunnansis W. W. Smith	DAOM 117495, Forrest 23457 ex K [Type of spp.]
helicalis Savile	Pedicularis capitata Adams	DAOM 60126, Savile 3558 [Holotype]
nesodes Arth. & Holw.	Lamourouxia viscosa HBK.	DAOM 78151 and 108705, Holw. 275 [Isotypes]
paederotae Savile	Paederota ageria L.	Thuem., Myc. Univ. 2142 in DAOM as P. veronicarum [Holotype]
pedatissima Cunning.	Ourisia macrophylla Hook.	DAOM 78254, Reid & Fey 494 [Isotype]

Puccinia cont'd.	**Scrophulariaceae cont'd.**	
rufescens Diet. & Holw. var. rufescens	Pedicularis semibarbata A. Gray	Barth., N. Am. Ured. 1267 in DAOM **[Isotype]**
var. densiflora Savile	Pedicularis densiflora Benth. ex Hook.	DAOM 115400 (slide only) ex PUR 36325, Bethel **[Isotype** of var.]
veronicae-longifoliae Savile	Veronica longifolia L.	Kari, F. Exs. Fenn. 492 in DAOM **[Holotype]**
wulfeniae Diet. & Holw. ssp. saximontana Savile	Besseya wyomingensis (Nels.) Rydb.	DAOM 147782, Cumm. 65-62 ex PUR 61050 **[Isotype** of ssp.]
	Solanaceae	
aulica Jacks. & Holw.	Poecilochroma guitensis Meirs	DAOM 78360, Holw. 363 **[Isotype]**
poecilochromae Jacks. & Holw.	Solanum montanum L.	DAOM 77165, Holw. 875 **[Isotype]**
	Tamaricaceae	
thuemenia Voss	Myricaria germanica Desv.	Thuem., Myc. Univ. 942 in DAOM **[Isotype]**
	Tiliaceae	
triumfettae Diet. & Holw.	Triumfetta semitriloba (L.) Jacq.	Vest., Microm. rare. sel. 493 in DAOM **[Isotype]**

Puccinia cont'd.	**Valerianaceae**	
vinulla Jacks. & Holw.	Valeriana scandens L.	DAOM 78886, Holw. 1746 **[Isotype]**
	Verbenaceae	
conjuncta Diet. & Holw.	Lippia pringlei Briq.	DAOM 77442 = Barth., N. Am. Ured. 1316, Holw. 3719B **[Isotype]**
mariae Jacks. & Holw.	Lippia sp.	DAOM 78042, Holw. 1719 **[Isotype]**
permagna Arth. & Holw.	Lippia myriocephala Schl. & Cham.	DAOM 78267, Holw. 404 **[Isotype]**
	Violaceae	
canadensis Arth.	Viola orbiculata Geyer ex Holz.	Holw. s.n., in DAOM, Glacier, B.C., 3 Sept. 1902 **[Paratype]**
effusa Diet. & Holw.	Viola lobata Benth.	DAOM 108384, Holw. s.n., Dunsmuir, Cal., 1894 **[Isotype]**
glacieri Savile	Viola glabella Nutt.	DAOM 147534, ex Barth., N. Am. Ured. 1058, Holw. s.n. **[Holotype]**
violae (Schum.) DC. ssp. americana Savile	Viola palustris L.	Barth., N. Am. Ured. 1575 in DAOM **[Holotype of ssp.]**

PUCCINIASTRUM	**Aceraceae**	
hikosanense Hirats. f.	Acer rufinerve Sieb. & Zucc.	DAOM 29984, Katsuki [Isotype]
	Caprifoliaceae	
miyabeanum Hirats.	Viburnum furcatum Bl.	DAOM 32004, Naoharu Hiratsuka [Isotype]
	Clethraceae	
kusanoi Diet.	Clethra barinervis Sieb. & Zucc.	DAOM 29998, Kusano [Isotype]
	Fagaceae	
fagi Yamada	Fagus crenata Blume	DAOM 29978, Yamada [Isotype]
	Hydrangeaceae	
hydrangeae-petiolaridis Hirats. f.	Hydrangea petiolaris Sieb. & Zucc.	DAOM 29987, Hirats. f. [Isotype]
	Rosaceae	
pseudo-cerasi (Hirats.) Jørst. (Thekopsora p.-c.)	Prunus cerasus L.	DAOM 29947, Naoharu Hiratsuka [part of Type]

Pucciniastrum cont'd.	**Styraceae**	
styracinum Hirats.	Styrax obassia Sieb. & Zucc.	DAOM 79027, Naoharu Hiratsuka, 22 Sept. 1896 [part of **Type**]
	Theaceae	
yoshinagai Hirats. f.	Stewartia pseudocamellia Maxim.	DAOM 32093, Yoshinaga **[Isotype]**
PUCCINIOSIRA	**Solanaceae**	
holwayi Jacks.	Solanum laxiflorum Sendt.	DAOM 79031, Holw. 1434 **[Isotype]**
RAVENELIA	**Fabaceae**	
annulata Long	Lysiloma bahamensis Benth. as L. latisiliqua	DAOM 79041, Long 4623 = Barth., Ured. 1882 in DAOM **[Isotype]**
bizonata Arth. & Holw.	Calliandra sp.	DAOM 108756, Holw. 762 **[Paratype]**
cumminsii Baxt.	Acacia willardiana Rose	DAOM 116121, Cumm. 62-57 ex PUR 59932 **[Isotype]**
distans Arth. & Holw.	"Mimosaceae"	DAOM 108757 = 79049, Holw. 535 **[Isotype]**

Ravenelia cont'd.	**Fabaceae cont'd.**	
echinata Lagerh. & Diet. var. ectypa (Arth. & Holw.) Cumm. (R. ectypa)	Calliandra gracilis Klotsch	DAOM 79051, Holw. 296 **[Isotype of var.]**
expanse Diet. & Holw.	Acacia tequilana Wats.	Barth., N. Am. Ured. 179 in DAOM **[Isotype]**
faceta Jacks. & Holw.	Cassia sp.	DAOM 79056, Holw. 1091 **[Isotype]**
idonea Jacks. & Holw.	Acacia sp.	DAOM 79060, Holw. 1055 **[Isotype]**
irregularis Jacks. & Holw.	Acacia sp.	DAOM 79070, Holw. 1416 (Brazil) **[Isotype]** Later homonym of R. irregularis Arth. see N. Am. Fl. 7(2): 142-143. 1907
rata Jacks. & Holw.	Acacia pedicellata Benth.	DAOM 79086, Holw. 1032 **[Isotype]**
sololensis Arth. & Holw.	Lysiloma acapulcensis Benth.	DAOM 79090, Holw. 147 **[Isotype]**
theiseniana Syd.	"Legumenosen-Strauch"	DAOM 79093, Rick **[Type]**
ROESTELIA	**Cupressaceae**	
brucensis Parmelee	Juniperus horizontalis Moench	DAOM 91910, Parmelee 720 & Kern **[Holotype]**
SKIERKA	**Sapindaceae**	
holwayi Arth.	Thowinidium sp.	DAOM 79104, Holw. 849 **[Isotype]**

SORATEAE	**Fabaceae**	
holwayii (Jacks.) Cumm. & Y. Hirats. (Mimema h.)	Cassia ?versicolor Meyen	DAOM 76560, Holw. 690 **[Isotype]**
SPHAEROPHRAGMIUM	**Fabaceae**	
everinum Syd.	Dialium guineense Willd.	DAOM 39031, Deighton 206 **[Isotype]**
TRIPHRAGMIOPSIS	**Ranunculaceae**	
isopryri (Moug. & Nestler) Tranz. (Triphragmium i.)	Isopyrum thalictroides L.	DAOM 58810, Moug. & Nestler, Stirpes Crypt. 892 **[Isotype]**
UREDINOPSIS	**Pteridophytes**	
americana Syd.	Onoclea sensibilis L.	DAOM 7067, Rel. Farlowiana, Seymour and Noyes, Sept. 1891 **[Isotype]**
arthurii Faull	Woodwardia virginica (L.) J.E. Sm.	DAOM 5428 = 84232, Darker 5465 **[Paratype]**
coplandii Syd.	Athyrium felix-foemina (L.) Roth as A. cyclosorum	DAOM 79661 = Syd., Ured. 1790 in DAOM **[Isotype]**
kameiana Faull	Pteridium aquilinum (L.) Kuhn	DAOM 79667, K. Hara, 20 Nov 1911 = Syd., F. exot. exs. 224 in DAOM **[Paratype]**

Uredinopsis cont'd.	**Peridophytes cont'd.**	
longimucronata Faull	Arthyrium angustatum (Willd.) Presl.	DAOM 84235, Darker 3531 **[Paratype]**
struthiopteridis Stormer	Struthiiopteris germanica Willd.	DAOM 79701, Stormer **[Topotype]**
woodsiae Kamei	Woodsia polystichoides Eat.	DAOM 29746, S. Kamei **[Isotype** ex HH]
UREDO	**Asteraceae/Mutisieae**	
nassauviae Vest.	Nassauvia serpens Urv.	Vest., Microm. rar. sel. 1190 in DAOM **[Isotype]**
	Bignoniaceae	
detecta Mains	Arrabidaea floribunda (HBK.) Loes.	DAOM 43756, Mains 3699 **[Isotype]**
	Chenopodiaceae	
spirostachydis Arth.	Allenrolfea occidentalis (Wats.) Kuntze	DAOM 36573, Jones 7815 **[Isotype]**
	Convolvulaceae	
operculina Syd.	Operculina turpenthum Manso	DAOM 79709, Merrill 8385 **[Isotype]**

Uredo cont'd.	**Cupressaceae**	
apecheca Peters.	Juniperus deppeana Steud.	DAOM 114542, Peterson 66-50 **[Isotype]**
	Lamiaceae	
sphacelicola Diet. & Holw.	Sphacele calycina Benth.	DAOM 108531, Blasdale s.n., May 1893 **[Isotype]**
	Liliaceae	
phormi Cunn.	Phormium tenax Forst.	DAOM 62214, Cunn. [? **Isotype]**
	Poaceae	
zeugitis Arth. & Holw.	Zeugites hartwegi Fourn.	DAOM 108770, Holw. 49 **[Isotype]**
	Pteridophytes	
aztechana Peters.	Asplenium monanthes L.	DAOM 114544, Peterson 63-55 **[Isotype]**
UROMYCES	**Alliaceae**	
primaverilis Speg. ssp. nothoscordi (Syd.) Savile (Uromyces n.)	Nothoscordum bivalve (L.) Britt.	DAOM 83836 (slide only) ex PUR 34913 **[Isotype of ssp.]**

Uromyces cont'd.	**Alliaceae cont'd.**	
ssp. primaverilis	Allium striatellum Lindl.	DAOM 54721 = Speg., Dec. Myc. Arg. 31 **[Authentic]**
	Asteraceae/Heliantheae	
aspiliae Jacks. & Holw.	Aspilia phyllostachya Baker	DAOM 79208, Holw. 1271 **[Isotype]**
sphaericus Jacks. & Holw.	Perymenium ecuadorium Blake	DAOM 79583, Holw. 828 **[Isotype]**
	Asteraceae/Inuleae	
amoenus Syd.	Anaphalis margaritacea (L.) Benth. & Hook.	Ell. & Ev., F. Col. 1795 in DAOM **[Isotype]**
	Asteraceae/Senecioneae	
senecionicola Arth.	Senecio roldana DC.	DAOM 109128, Holw. 5183 **[Isotype]**
	Boraginaceae	
dolichosporus Diet. & Holw.	Tournefortia velutina HBK.	DAOM 79289 = Rel. Farl. 778 in DAOM, Pringle **[Isotype]**
	Campanulaceae	
peracarpae Ito & Tochinai	Peracarpa carnosa Hook. f.	DAOM 33125, Hirats. f. **[Isotype]**

Uromyces cont'd.	**Caryophyllaceae**	
inaequialtus Lasch	Silene nutans L.	Rab., Fungi Europ. 94 in DAOM **[Isotype]**
	Chenopodiaceae	
polycnemi McAlp.	Polycnemum pentandrum Muel. ex Miq.	DAOM 79497, McAlp. 198 **[Topotype]**
	Convolvulaceae	
vicinus Jacks. & Holw.	Ipomoea	DAOM 79633, 79634, 79635, 79636, Holw. 1995, 1656, 1905 and 1255 respect. **[Paratypes]**
	Cucurbitaceae	
anguriae Jacks. & Holw.	Anguira warmingiana Cogn.	DAOM 79192, Holw. 1432 **[Isotype]**
novissimus Speg.	Trianospermae ficifolia DC.	DAOM 54708 = Speg., Dec. Myc. Arg. 18 **[Authentic]**
ratus Jacks. & Holw.	Cayaponia ternata Cogn.	DAOM 79525, Holw. 1251 **[Isotype]**
	Cyperaceae	
americanus Speg. var. californicus Savile	Scirpus californicus (Mey.) Britt.	Barth., N. Am. Ured. 1796 in DAOM **[Holotype of var.]**

Uromyces cont'd.	**Cyperaceae cont'd.**	
lineolataus (Desm.) Schroet. ssp. nearcticus Savile	Scirpus maritimus L.	Rab., Fungi Europ. 2077 in DAOM **[Isotype** of ssp.]
oblectaneus Jacks. & Holw.	Rhynchospora exaltata Kunth	DAOM 79454; Holw. 1113 **[Isotype]**
	Euphorbiaceae	
actinostemonis Jacks. & Holw.	Actinostemon concolor Muell.	DAOM 79164, Holw. 1093 **[Isotype]**
cisneroanus Speg.	Sapium biglandulosa Muell. as Excaecaria b.	DAOM 54707 = Speg., Dec. Myc. Arg. 17, J. Cisneros, 1880 **[Authentic]**
manihotus-catingae P. Henn.	Manihot catingae Ule	DAOM 79429, Ule 3323 **[Isotype]**
oaxacanus Diet. & Holw.	Jatropha urens L.	DAOM 109115, Holw. 3690 **[Isotype]**
tolerandus Jacks. & Holw.	Manihot sp.	DAOM 79599, Holw. 1827 **[Isotype]**
tranzschelii Syd.	Euphorbia montana Engelm.	Ell. & Ev., F. Col. 1069 in DAOM as U. scutellatus **[Topotype]**

Uromyces cont'd.	**Fabaceae**	
amurensis Kom.	Kladrastidis amurensis Benth.	Jac., Kom., Tranz., F. Ross. Exs. 157-158 in DAOM **[Isotype]**
azukicola S. Hirata	Phaseolus angularis Wright	DAOM 32966 ex HH, Hirata **[Isotype]**
bauhiniicola Arth.	Bauhinia pringlei Wats.	DAOM 109079, Holw. 5060 **[Isotype]**
bradburyae Jacks. & Holw.	Bradburya virginiana (L.) Kuntze and B. pubescens (Benth.) Kuntze	DAOM 79235, Holw. 1801 **[Syntype]** and DAOM 79234, Holw. 1735 **[Syntype]**
clitoriae Arth.	Clitoria mexicana Lk.	DAOM 109092, Holw. 3088 **[Isotype]**
cologaniae Arth.	Cologania pulchella HBK.	DAOM 109093, Holw. 3179 **[Paratype]**
hardenbergiae McAlp.	Hardenbergia monophylla Benth.	DAOM 79321, Robinson **[Authentic]**
hedysari-paniculati (Schw.) Farl. (Puccinia h.-p.)	Desmodium sp.	Ellis, N. Am. Fungi 246 in DAOM **[Isotype]**
lapponicus Lagerh. var. oxytropis Savile	Oxytropis campestris (L.) DC. var. terrae-novae (Fern.) Barneby	DAOM 140001, Savile 2862 **[Holotype** of var.**]**
lezpedezae-procumbentis (Schw.) Lagh. (Puccinia l.-p.)	Lezpedeza hirta (L.) Ell.	Barth., N. Am. Ured. 2392 in DAOM **[Isotype]**
mexicanus Diet. & Holw.	Desmodium sp.	DAOM 109113, Holw., 22 Sept. 1896 at Cuernavaca, Mexico **[Paratype]**

Uromyces cont'd.	**Fabaceae cont'd.**	
occidentalis Diet.	Lupinus latifolius J. Agar.	Barth., N. Am. Ured. 96 in DAOM, Blasdale [Isotype]
rostratus P. Henn.(= U. neurocarapi Diet.)	Clitoria cajanifolia (Presl.) Benth.	DAOM 79535, Ule, Herb. Brasil. 2152 [Isotype]
shikokianus Kussano	Cladrastis shikokiana Mak.	DAOM 79559, Yoshinaga [Isotype]
	Grossulariaceae	
ribicola Jacks. & Holw.	Ribes albifolium R. & P.	DAOM 79534, Holw. 568 [Isotype]
	Hippocrataceae	
pereskiae Jacks. & Holw.	Pereskia grandifolia Haw.	DAOM 79470, Holw. 1123 [Isotype]
	Iridaceae	
croci Pass.	Crocus biflorus Mill.	Rab., Fungi Europ. 2078 in DAOM [Isotype]
probus Arth.	Sisyrhynchium grandiflorium Dougl. (= Olsynium g.)	Ell. & Ev., N. Am. Fungi 3137 in DAOM as U. sisyrhynchii Mont. [Isotype]

Uromyces cont'd.	**Loranthaceae**	
loranthi Jacks. & Holw.	Loranthus sp.	DAOM 79420, Holw. 1358 **[Isotype]**
socius Arth. & Holw.	Loranthus sp.	DAOM 108803, Holw. 539 **[Paratype]**. Note: other paratypes in DAOM include Holw. 185, 665, 765, but not 545 designated TYPE.
	Plumbaginaceae	
armeriae (Schl.) Lev. ssp. hudsonica Savile & Conners	Armeria maritima (Mill.) Willd.	DAOM 23450, Savile 447 **[Holotype** of ssp.]
ssp. pacificus Savile & Conners	Armeria maritima (Mill.) Willd.	DAOM 5627, Newton **[Holotype** of ssp.]
limonii-caroliniani Savile & Conners	Limonium caroliniana L.	DAOM 18686, Payette 46-43 **[Holotype]**
	Poaceae	
beckmanniae Jacks.	Beckmannia erucaeformis (L.) Host	DAOM 23143 (= 79213), Jackson 3145 **[Isotype]**
halstedii De T.	Leersia virginica (L.) Swartz	Ell. & Ev., N. Am. Fungi 2227 as U. digitatus Halsted, in DAOM **[Isotype]**

Uromyces cont'd.	**Poaceae cont'd.**	
peckianus Farl.	Distichlis spicatum (L.) Greene as Brizopyrum s.	Ell., N. Am. Fungi 240 in DAOM, Farlow **[Isotype]**
ssp. rugulosa Savile	Distichlis spicatum (L.) Greene	DAOM 151389, Savile 5150 **[Holotype** of ssp.]
panici-sanguinalis Rangel	Panicum sanguinale L.	DAOM 79465, Rangel 1103 **[Isotype]**
	Polygonaceae	
bisbyi Savile	Eriogonum parviflorus J.E. Sm.	DAOM 110295 ex PUR 14003, Fawcett **[Isotype]**
intricatus Cke. var. major Savile	Eriogonum flavum Nutt.	DAOM 1406, Sallans & Conners **[Holotype** of var.]
var. nivea Savile	Eriogonum niveum Dougl.	DAOM 110310, Taylor 4282 & Staudt **[Holotype** of var.]
var. pluriporosus Savile	Eriogonum microthecum Nutt.	Barth. & Bethel, F. Col. 3591 in DAOM **[Holotype** of var.]
var. umbellati Savile	Eriogonum umbellatum Torr.	Ell. & Ev., N. Am. Fungi 2232 in DAOM **[Isotype** of var.]
	Portulacaceae	
claytoniae Clint. & Peck	Claytonia lanceolata Pursh	DAOM 46540 (slide only) ex NYS, Peck **[Type]**

Uromyces cont'd.	**Portulacaceae cont'd.**	
unitus Peck ssp. montanensis Savile	Lewisia redeviva Pursh	Ell. & Ev., F. Col. 1373 in DAOM, Kelsey [Type of ssp.]
ssp. pacificus Savile	Spraguea umbellata Torr.	DAOM 46576 ex PUR 46735, Tracey 12705 [Type of ssp.]
ssp. spraguae (Hark.) Savile	Spraguea umbellata Torr.	Rab., Wint., F. Eur. 3309 in DAOM [Type of ssp.]
ssp. unitus	Lewisia columbiana (Howell) Robinson	DAOM 46554 (slides only) ex PUR 34979, Brandegee [Type of Uromyces u.]
	Rubiaceae	
asperulae McAlp.	Asperula oligantha Muell ex Miq.	DAOM 79707, Robinson 1460 [Paratype]
galii Diet.	Galium aparine L.	DAOM 79296, Yoshinaga [Isotype]
psychotriae Henn.	Psychotria jura	DAOM 79516, Ule ex Herb. Bras. 3085 [Type material]
	Solanaceae	
salpichroae Jacks. & Holw.	Salpichroa sp.	DAOM 79542, Holw. 585 [Isotype]

Uromyces cont'd.	**Sparganiaceae**	
sparganii Clint. & Peck ssp. asiaticus Parmelee & Savile	Acorus calamus L.	DAOM 43631, Ramakrishnan & Rangaswami, 24 Mar. 1948 [**Type** of ssp.]
UROMYCLADIUM	**Fabaceae**	
bisporum McAlp.	Acacia dealbata Lk.	DAOM 79712, Robinson [**Isotype**]
simplex McAlp.	Acacia ?montana Benth.	DAOM 79717, French, 18 Mar. 1907 [**Authentic**]
UROPYXIS	**Cucurbitaceae**	
arisanensis (Hirats. f. et Hash.) Ito & Muray (Puccinia a.)	Melothria mucronata Cogn.	DAOM 32705, Hirats. f. [part of **Type**]
	Fabaceae	
diphysae (Arth.) Cumm. (Calliospora d.)	Diphysa suberosa Wats.	DAOM 109136, Holw. 5082 [**Isotype**]
holwayi (Arth.) Arth. (Calliospora h.)	Eysenhardtia amorphoides HBK.	DAOM 76129, Holw. 5068 [**Paratype**]
petalstemonis (Farl.) De T. (Puccinia p.)	Petalstemon sp.	DAOM 192741, Pammel [**Isotype**]

MYCOTAXON

Volume LX, pp. 79-102 October-December 1996

SOME STEMONITALES (MYXOMYCETES) FROM THE STATE OF TLAXCALA, MEXICO

M. RODRÍGUEZ-PALMA

and

A. ESTRADA-TORRES

Laboratorio de Micología
Centro de Investigación en Ciencias Biológicas
Universidad Autónoma de Tlaxcala
(Postal Address: Apdo. Postal 63-389.
México 02800, D.F., México).

ABSTRACT

Twenty species and two varieties of Stemonitales were found in six localities from the State of Tlaxcala, Mexico. ***Schenella simplex*** Macbr., ***Diacheopsis insessa*** (G. Lister) Ing, and ***Stemonitis microsperma*** Ing are recorded for the first time for the Neotropics, and *S.* ***hyperopta*** Meylan and ***Comatricha rubens*** A. Lister are new records for Mexico. The collection of *Schenella simplex* is the first made outside the type locality in Yosemite National Park, California, U.S.A.

RESUMEN

Se estudiaron veinte especies y dos variedades de Stemonitales procedentes de seis localidades del estado de Tlaxcala, México. ***Schenella simplex*** Macbr., ***Diacheopsis insessa*** (G. Lister) Ing y ***Stemonitis microsperma*** Ing se registran por primera vez de la zona Neotropical, y ***S. hyperopta*** (Meylan) Nann.-Brem. y ***Comatricha rubens*** A. Lister son nuevos registros para la República Mexicana. La colección de *Schenella simplex* es la primera realizada fuera de la localidad tipo en el Parque Nacional de Yosemite, California, Estados Unidos.

INTRODUCTION

Most of the studies on Myxomycetes from Mexico include a list of species based on a lack of regular sampling in time and space. For this reason, the species composition of Mexican myxomycete communities is only partially known. The best explored areas are found in the States of Veracruz, Jalisco and Nuevo Leon (Braun & Keller, 1986; Trujillo, 1988; Trujillo *et al.*, 1986; Ogata *et al.*, 1994), but only a few records have been made in other areas. In the State of Tlaxcala, Central Mexico, there are sixteen species of Myxomycetes recorded in the literature (Braun & Keller, 1976; Keller & Braun, 1977; Villarreal, 1990; Hernández-Cuevas *et al.*, 1991; Galindo, 1992), none of which belong to the Stemonitales.

In this study, we list and discuss the species of the Order Stemonitales which we have found since 1988 in the State of Tlaxcala.

MATERIALS AND METHODS

Most of the specimens studied (98%) were collected between 1988 and 1991, from ***Abies-Pinus*** forest, in "Cañada Grande", Malintzin Volcano, State of Tlaxcala, Mexico. The remainder of the specimens are from five other localities in this State.

Delimitation of species follows Martin & Alexopoulos (1969), Farr (1976), Kowalski (1970; 1975), Lakhanpal & Mukerji (1981), Bersan (1990) and Nannenga-Bremekamp (1991). In some cases, the colors of the structures in the descriptions were based on the Munsell color chart (Munsell, 1992). The new records for Mexico and some unusual species are fully described; others are only listed or discussed when deemed necessary.

Specimens are deposited in the Mycological Collection of the Herbarium "TLXM", Centro de Investigación en Ciencias Biológicas, Universidad Autónoma de Tlaxcala, with some duplicates at the ENCB (Escuela Nacional de Ciencias Biológicas, Instituto Politécnico Nacional. México, D.F.) and IZTA (Escuela Nacional de Estudios Profesionales, Universidad Nacional Autónoma de México. Tlalnepantla, Estado de México) Herbaria.

The following abbreviations are used for the names of collectors : Estrada Torres (*ET*), Galindo Flores (*GF*), Hernández Cuevas (*HC*), Montoya Esquivel (*ME*) and Rodríguez Palma (*RP*).

DESCRIPTION OF THE MAIN STUDY AREA

The State of Tlaxcala is found in Central Mexico, between 97° 37′ 07′′ and 98° 42′ 51′′ West longitude, and 19° 05′ 43′′ and 19° 44′ 07′′ North latitude. The highest elevation in the state is Malintzin Volcano, which is in the southwestern portion, and is situated between 97° 55′ 42′′ and 98° 08′ 07′′ West longitude, and 19° 08′36′′ and 19° 19′ 98′′ North latitude.

A great cliff called "Cañada Grande" or "Fractura Central" is found on the east side of the Volcano. The natural vegetation in this place is found above 3,100 m and is dominated by an ***Abies religiosa*** forest. In some places. there is ***Pinus-Abies*** forest, with ***Pinus montezumae*** and ***P. hartwegii*** mixed with ***A. religiosa***. At 3,250 m or higher, ***P. hartwegii*** grows in pure stands (Acosta & Kong, 1991). The soils are gravely-sandy fluvisols with fragments of stones (CETENAL, 1975 A). The climate is temperate between 2,500 and 3,000 m and cold at 3,000 or higher, and the rainy season occurs in summer (May to November). In the cold zone, the annual mean temperatures are between 6 and 12°C. (CETENAL, 1975 B).

LIST AND DESCRIPTION OF THE SPECIES

Family Schenellaceae

Schenella simplex Macbr.

Figs. 2A and 3A.

Pseudoaethalium oval in outline, covered by a thin continuous membrane, pale gray, sometimes bright; sporangia cylindrical or columnar; peridium thick, persistent at the apex and at the base and forming cap-like structures, evanescent elsewhere; capillitium brown to yellowish brown when viewed by transmitted light, interwoven, coiled and forming a columnar helix (Fig. 2A); spores black in the mass, dark yellowish brown by transmitted light, globose to ovoid, 5 - 6 μm in diameter, with a thick wall and a verrucose ornamentation, up to 1 μm in height and forming an irregular reticulum (Fig. 3A), with a conspicuous germinal pore. Plasmodium unknown.

Habitat: On dead leaves of angiosperm, in *Abies-Pinus* forest

Specimen studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano, 13 June, 1990, 3300 m, RP # 1775.

Observations: ***Schenella simplex*** is a rare myxomycete species and was collected only once during our two-year study. Unfortunately, the specimen found in Tlaxcala is badly damaged and consists only of the remains of one pseudoaethalium with a few intact sporangia. Nevertheless, this collection matches the description given by Martin & Alexopoulos (1969). As Martin ***et al.*** (1983) had previously noted, ***Schenella*** has been frequently considered as a doubtful myxomycete. Obviously, one fragmented specimen cannot elucidate the status of this genus.

There are two species of ***Schenella*** (Martin & Alexopoulos, 1969) both previously known only from their type collections. ***Schenella simplex*** differs from ***S. microspora*** Mart. by the color of the spores which are reddish in the latter species. In ***S. microspora,*** the peridial remains are less well developed than those of ***S. simplex,*** the capillitium is rugose and the spores are smaller with less prominent ornamentation.

Family Stemonitaceae

Colloderma roblustum Meylan

Habitat: On decayed wood and bark of conifers, mosses and liverworts in ***Abies-Pinus*** forest.

Specimens studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano, 27 September (Sept.), 1988, 3450 m, ***HC # 707***; 11 January

(Jan.), 1990, 3250 m, *GF # 1241*; 3300 m, *GF # 1256*; 9 February (Feb.), 1990, 3200 m, *GF # 1334*; 3250 m, *GF # 1335*; 3500 m, *GF # 1401*; *GF # 1409*; 11 March, 1991, *RP # 1951*.

Diacheopsis insessa (G. Lister) Ing
Figs. 1 and 2B-D .

Subplasmodiocarpous or sporangiate, sessile (Fig. 2B), 0.4-1.3 mm in length, 0.2-0.4 mm in height; peridium membranous, translucent, nearly evanescent, grayish blue or iridescent with gray or purplish tints; hypothallus membranous, inconspicuous, hyaline; capillitium sparse and elastic, grayish to black, formed by branched and anastomosed threads, arising from the base of the sporangium; capillitial threads, 1.0-1.5(-2.0)µm in diameter, dark gray by transmitted light, with free ends and many elliptical to rounded dark nodes, giving a beaded appearance (Figs. 1 and 2C); nodes (1.5-) 2.5-3.0 (-4.0) µm in diameter; spores black in the mass, dark gray by transmitted light, globose, spinose, 18-19 µm in diameter (Figs. 1 and 2D). Plasmodium unknown.

Habitat: On decayed wood of conifers, in ***Abies-Pinus*** forest.

Specimen studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano. 14 April, 1989, 3500 m, *HC # 1025*.

Observations: There are twelve species that belong to the genus ***Diacheopsis***, most of them known only from the type specimen (Kowalski, 1975; Mitchell, 1995). For this reason the genus is poorly understood. ***Diacheopsis insessa*** is very similar to ***D. effusa*** Kow., but the latter species has an almost smooth capillitium which firmly adheres to the peridium by membranous infundibuliform expansions, and smaller spores (Kowalski, 1975). ***Diacheopsis nannengae*** Mor., Ill. & Heyk. (Moreno ***et al.*** 1989) is very close to ***D. insessa***, but the brown capillitium, together with the 9-11 µm diameter spores, distinguish the former species.

Enerthenema papillatum (Pers.) Rost.

Habitat: On decayed wood and bark of conifers and mosses in ***Abies-Pinus*** forest.

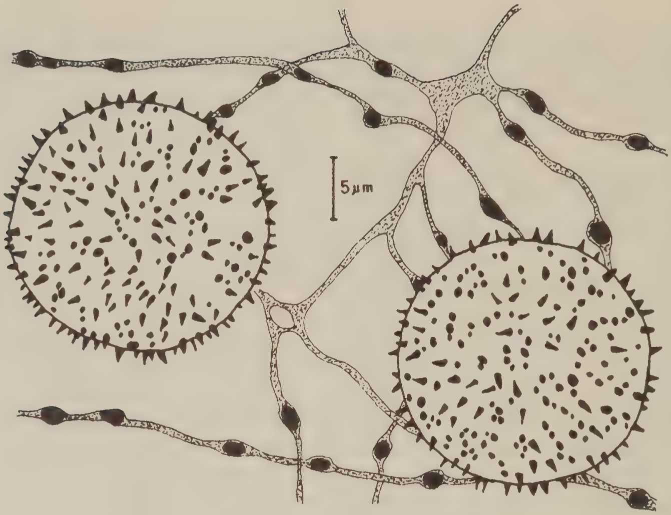


Fig. 1. Capillitium and spores of *Diacheopsis insessa*

Specimens studied: STATE OF TLAXCALA. Ixtenco Municipality, east slope of the Malintzin Volcano, 27 May, 1988, ***RP # 35***; 8 July, 1988, 3250 m, ***GF # 114***; 3300 m, ***GF # 203***; 4 August, 1989, 3400 m, ***RP # 1146.***

Stemonitis axifera var. ***axifera*** (Bull.) Macbr.

Habitat: On decayed wood of both conifers and angiosperms, mosses, lichens and liverworts, in ***Abies-Pinus, Pseudotsuga-Abies-Pinus*** forests and riparian mixed hardwood forest.

Specimens studied:STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano, 26 March, 1988, 3350 m, ***GF # 823***; 21 May, 1988, ***GF # 31***; 8 July, 1988, 3250 m, ***RP # 129***; 3300 m, ***GF # 109***; 13 July, 1988, ***HC # 150***; 3100 m, ***RP # 148***, ***RP # 150***; 3350 m, ***RP # 240***; 14 July, 1988, 3350 m, ***RP # 191***; 30 July, 1988, 3150 m, ***GF # 215***; 12 August, 1988, 3250 m, ***GF # 339***; 3450 m, ***HC # 366***; 1 Sept., 1988, 3250 m, ***RP # 352***; 15 Sept., 1988, 3500 m, ***RP # 410, HC # 476, HC # 485***; 16 Sept., 1988, 3100 m, ***RP # 534***; 27 Sept., 1988, 3400 m, ***GF # 653***; 4 Nov., 1988, 3150 m, ***HC # 881***; 21 June, 1989, 3300 m, ***RP # 1070***; 17 July, 1989, 3100 m, ***HC # 2079***; 21 July, 1989, 3150 m, ***GF # 1694***; 3300 m, ***RP # 1120***; 4 August, 1989, 3250 m, ***GF # 1075, GF # 1734***; 18 August, 1989, 3300 m, ***RP # 1875***; 9 Feb., 1990, 3450 m, ***HC # 1702***; 9 March, 1990, ***RP # 1526, RP # 1543, RP # 1551, RP # 1554***; 23 March, 1990, 3350 m, ***HC # 1851***; 19 May, 1990, 3400 m, ***HC # 1894***. Yauquemehcan Municipality, Atlihuetzía Falls. 20 July, 1989, ***RP # 1079***. Terrenate Municipality, Villarreal. 6 Oct., 1989, ***ME # 572***.

Stemonitis axifera var. ***smithii*** (Macbr.) Hagelst.

Habitat: On decayed wood and bark of conifers, mosses and lichens, in *Abies-Pinus*, or *Abies-Pinus-Quercus* forest.

Specimens studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano, 8 July, 1988, ***GF # 69***; 14 July, 1988, 3500 m, ***HC # 156***; 12 August, 1988, 3450 m, ***HC # 365, GF # 389***; 2 Sept., 1988, 3300 m, ***RP # 401***; 15 Sep., 1988, 3500 m, ***RP # 418***; 16 Sept., 1988, 3150 m, ***GF # 589***; 27 Sept., 1988, 3200 m, ***RP # 641***; 3450 m, ***GF # 683***; 3500 m, ***RP # 550***; 28 Sept., 1988, 3150 m, ***HC # 779***; 21 April, 1989, 3350 m, ***HC # 1134***; 4 August, 1989, 3400 m, ***GF # 1741***; 31 August, 1989, 3400 m, ***GF # 1123***; 20 Oct., 1989, 3350 m, ***HC # 1509***; 9 Feb, 1990, 3250 m, ***GF # 1314***; 19 April, 1990, 3250 m, ***GF # 1492***. Terrenate Municipality, Villarreal, 27 July, 1989, ***GF # 1726***. Tlaxco Municipality, Rancho Escondido, 8 Sept., 1989, ***HC # 1464, HC # 1465***.

Observations: Martin & Alexopoulos (1969) considered this variety of *S. axifera* to be a separate species. However, Farr (1976) refuted its specific status, because all of its features, except the size of spores and sporangia, are basically the same as those of *S. axifera*. In the specimens from the state of Tlaxcala, we find a great variation in these characteristics, intergrading from small to large spores and sporangia, and from very close to open surface-net. This suggests that all our specimens belong to the same species. For this reason, we applied an analysis of variance to the measurements of 50 spores for each studied specimen, finding that the means of at least some collections were different (p= 0.05) from the remainder. To test for significant differences we used the Tukey test. We find that the specimens listed under *S. axifera* var. *axifera* have spores with mean sizes different from the specimens listed under *S. axifera* var. *smithii*. The specimens with small spores always have small sporangia; however, in specimens with medium to large spores, the size of the sporangia is variable. The result of the statistical analysis suggests the presence of two independent taxa but we consider it unjustifiable to segregate two species on the sole basis of spore-size and prefer to follow Farr (1976), considering the specimens with smaller spores as a variety of *S. axifera*.

Stemonitis confluens Cooke & Ellis
≡***Symphytocarpus confluens*** (Cooke & Ellis)Ing & Nann.-Brem.

Figs. 2E-F.

Pseudoaethalia 1.5-3.5 mm height, 1-5 cm in diameter, deep black; sporangia 0.5-0.8 mm in diameter, cylindrical, sessile to almost sessile, fused in the middle by membranous expansions, separated at the tips and bases; hypothallus membranous to more or less coriaceous, purple brown to yellowish; stalk when present short, up to 0.5 mm, black, irregular; peridium fugacious except for some rounded plates which are reddish brown in transmitted light, smooth and interconnecting the capillitium between two adjacent sporangia (Fig. 2E); columella black, glossy, irregular, dissipating before reaching the top of the sporangium, sometimes branched and then with membranous expansions between two branches or completely flattened and perforated; capillitium an open and irregular meshed reticulum of flattened, rigid, glossy and black threads which arise from the columella, dark reddish brown by transmitted light, with membranous and enlarged axils; spores black in mass, dark purple brown in transmitted light, 11-14 µm in diameter, spinulose, usually free but sometimes forming groups of 6-16 spores (Fig. 2F).

Habitat: Mainly on bark but also found on dead wood of conifers and lichens, in ***Abies-Pinus*** forest.

Specimens studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano, 30 July, 1988, 3100 m, *GF # 211*; 1 Sept., 1988, 3100 m, *GF # 420*;

16 Sept., 1988, 3100 m, *GF # 594*; 19 Dec., 1988, 3100 m, *GF # 854*; 7 July, 1989, 3100 m, *GF # 1672*; 9 Feb., 1990, 3100 m, *GF # 1310*.

Observations: The Mexican collections fit the description and figures of ***Stemonitis confluens*** given by Martin & Alexopoulos (1969), except in the size of the spores, which they cited as 11-12 µm. This species was considered as ***Symphytocarpus confluens*** by Nannenga-Bremekamp (1991). Our specimens fit the description given by Nannenga-Bremekamp (1991) except in the slightly larger size of the spores which she reported as 10-13 µm. The Mexican specimens also differ from Nannenga-Bremekamp's (1991) description in always having a well developed columella with enlarged membranous expansions. Most of our specimens have free spores but specimens GF-211 and GF-1310 have clustered spores. Martin & Alexopoulos (1969) mentioned the existence of a variety of ***Stemonitis confluens*** with grouped and somewhat larger spores from Japan, but they were not able to decide if this form was a different species or just a variant of the same species. In this sense, the studied collections are the answer to that problem, due to both variants (free or grouped spores) were collected always in a small area on the same decaying log. This suggests that they represent different generations of pseudoethalia growing under the influence of different environmental conditions. López ***et al.*** (1981) had previously reported this species from Mexico, and they illustrated both types of spores (free and clustered) apparently from the same specimen, although they did not otherwise draw attention to this feature in their description.

Stemonitis fusca Roth

Habitat: On decayed wood of conifers, bark and mycelium, in ***Abies-Pinus*** and ***Pseudotsuga-Abies-Pinus*** forests.

Specimens studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano, 8 July, 1988, 3200 m, *HC # 126*; 3350 m, *RP # 117*; 27 Sept., 1988, 3300 m, *GF # 892*; 3450 m, *RP # 586*; 26 Nov., 1988, 3150 m, *HC # 944*; 19 Dec., 1988, 3250 m, *GF # 860*; 4 August, 1989, 3200 m, *RP # 1857*; 9 Feb., 1990, 3300 m, *RP # 1447*.

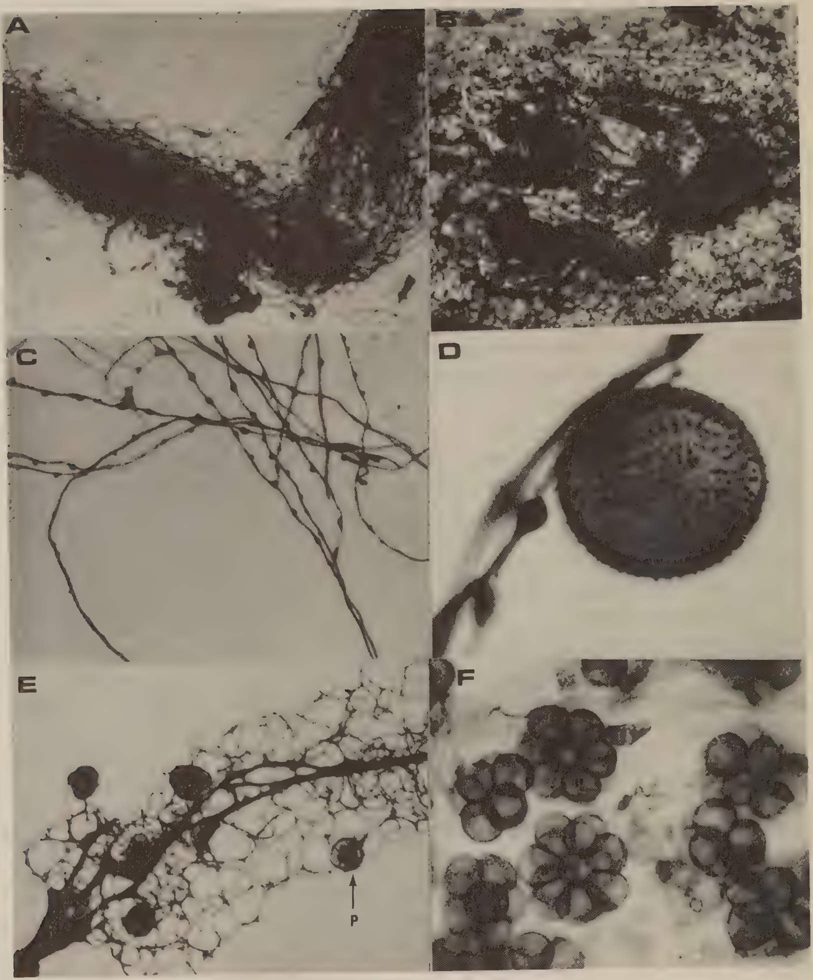


Fig. 2. A. ***Schenella simplex*** (*RP*-1775): capillitium (X 44). B-D. ***Diacheopsis insessa*** (*HC*-1025); B. Sporangia (X 22); C. Capillitium (X 250); D. Spore (X 1100). E-F. ***Stemonitis confluens***; E. Capillitium showing peridial rounded plates (p) (*GF*-594) (X 44); F. Group of spores (*GF*-1310) (X 440).

Terrenate Municipality, Villarreal, 23 Feb., 1990, *ET # 2922.*

Stemonitis hyperopta **Meylan**
≡***Stemonitopsis hyperopta*** (Meylan) Nann.-Brem.
Figs. 3B and 4A-B.

Fructifications in small groups, stalked, cylindrical to ovate-elongate, with obtuse apex, 2.5-6 mm in total height; sporangia 1.5-3 (-4) mm x 0.5-1 mm, light purplish brown to reddish brown; hypothallus reddish brown to dark brown, membranous; stalk black, bright, cylindric, 1/4 - 1/2 of the total height; columella continuous with the stipe, reaching the apex of the sporangium, tapering and dissipating into the capillitial branches; capillitium loose, sometimes with primary branches, forming a semi-open net inside and a thin and delicate net on the surface, breaking easily and then with many free paler ends; spores light red (Munsell: 2.5 YR 4/2) to reddish brown (Munsell: 5YR 3.5/2) in mass, very pale by transmitted light, globose, with a faint and incomplete reticulum formed by fine bands, 5.5-8 μm in diameter (Figs. 3B and 4A-B). Plasmodium unknown.

Habitat: Mainly on decayed wood but may also be found on fungus mycelium, moss leaves and foliose liverworts in *Abies-Pinus* forest.

Specimens studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano, 8 July, 1988, 3250 m, *RP # 127*; 13 July, 1988, 3200 m, *HC # 128*; 14 July, 1988, 3500 m, *GF # 157*; 18 August, 1988, 3250 m, *GF # 1754*; 1 Sept., 1988, 3200 m, *HC # 415*; 16 Sept., 1988, 3250 m, *RP # 502; GF # 562*; 3500 m, *HC # 619*; 28 Sept., 1988, 3100 m, *HC # 784, HC # 791*; 28 Oct., 1988, 3100 m, *HC # 787*; 7 July, 1989, 3100 m, *HC # 2014, HC # 2016, HC # 2017, # 2019*; 21 July, 1989, 3350 m, *RP # 1114*; 18 August, 1989, 3500 m, *GF # 1773*; 31 August, 1989, 3250 m, *RP # 1192*; 11 Jan., 1990, 3150 m, *RP # 1334*; 9 Feb., 1990, 3500 m, *GF # 1413*; 19 May, 1990, 3250 m, *GF # 1524*; 3400 m, *RP # 1734*; 13 Jun., 1990, 3250 m, *GF # 1560*; 3350 m, *RP # 1778*. Mariano Arista Municipality, Nanacamilpa, 25 August, 1989 *GF # 1096.*

Observations: The Mexican specimens have slightly larger stalks than those reported by Farr (1976) and Martin & Alexopoulos (1969). The superficial mesh at the apex of the sporangium is very fragile and breaks easily. Macroscopically ***Stemonitis virginiensis*** Rex resembles ***Stemonitis hyperopta*** but it can be separated by its darker color, spore ornamentation and hollow stalk.

Stemonitis microsperma Ing

Sporangia stalked, cylindrical-ovate to cylindrical, up to 1.6 x 0.5 mm; stalk black, shining, 1/3 of the total height, cylindrical or tapering gradually to the apex; hypothallus membranous, dark reddish brown; columella black, cylindrical or tapering and dissipating into the apical capillitium; capillitium arising along the columella as wide threads, branching dichotomously and forming an open net inside the sporangium, and close and delicate at the surface; spores purplish brown in the mass, pale brown by transmitted light, globose, 5.0 μm in diameter, faintly ornamented with a reticulum of delicate bands.

Habitat: Growing on moss leaves, in ***Abies-Pinus*** forest.

Specimen studied: STATE OF TLAXCALA: Ixtenco Municipality. east slope of the Malintzin Volcano. 20 Jan., 1989, 3250 m, *GF # 898*.

Observations: This species is distinctive because of the size of its sporangia and its small faintly banded-reticulate spores. It seems to be a very infrequent species, often growing on leaf litter.

Stemonitis nigrescens Rex

Figs. 3C and 4C-D.

Sporangia crowded, stalked, cylindrical, rounded or slightly acuminate at the apex (Fig. 4C), 1.3-3.0 mm tall, 0.3-0.5 mm in diameter, very dark grey (Munsell 5YR3/1 - 7.5YR3/1) to dark brown (Munsell 7.5YR3/2); hypothallus membranous, pale brown to reddish brown, continuous under the tufts. Stalk shiny black, 1.0-1.5 mm, 1/3 - 1/2 of the total height, hollow; peridium fugacious; columella apical, tapered and dissipating at the apex; capillitium arising from all the columella, formed by thin threads, dark brown to purplish brown in transmitted light, anastomosed, forming an intricate net; surface net delicate and sometimes breaking easily; spores dark reddish brown in mass, dull brown in transmitted light, globose, 9-11 μm in diameter, with an angular meshed reticulum formed of spines connected by ridges (Figs 3C and 4D).

Habitat: On dead wood of conifers, in ***Abies-Pinus*** forest.

Specimens studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano, 4 August, 1989, 3250 m, ***RP # 1147***; 19 May, 1990, 3500 m, ***RP # 1757***.

Observations: ***Stemonitis nigrescens*** is an unusual species which can be distinguished from other species of ***Stemonitis*** by its almost black sporangia and its spinose banded-reticulate spores. There are other species of ***Stemonitis*** with reticulate spores but only ***S. foliicola*** Ing has rows of spines connected by ridges. That species is distinguished from ***Stemonitis nigrescens*** by its smaller sporangia and spores (8-9 μm) and its particular habitat on dead leaves (Nannenga-Bremekamp, 1991).

Stemonitis pallida Wingate

Figs. 4E-G.

Habitat: On decayed wood of conifers and living mosses, ***Abies-Pinus*** forest.

Specimens studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano, 16 Sept., 1988, 3300 m, **RP # 490**; 22 August, 1990, ***RP # 1830***.

Observations: The distinctive features of this species are the shortly stalked and crowded sporangia (Fig. 4E), the peripheral spinose and fragile net which dissipates at the apex and the warted spores (Fig. 4F-G). Both of the specimens from Tlaxcala agree with Nannenga-Bremekamp's (1991) description, although they have slight differences in the ornamentation of the spores, being taller in one of them (RP-490). However, this variation falls within the range of the species (Nannenga-Bremekamp, 1991). This species usually grows on decaying wood but one of our specimens (RP-1830) was found on living mosses. ***Stemonitis pallida*** is close to ***S. herbatica*** which is frequently found on living plants, but this

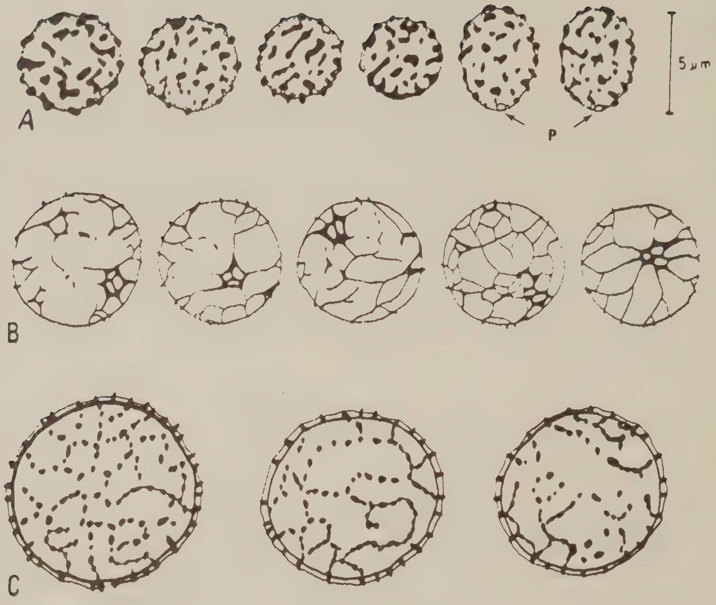


Fig. 3. Spores of some Mexican Stemonitales. A. *Schenella simplex, (p: germinal pore)*. B. *Stemonitis hyperopta*. C. *Stemonitis nigrescens*.

species has a complete surface net without spines. *Stemonitis flavogenita* is also similar but it usually has an apical membranous expansion in the columella.

Stemonitis splendens Rost.

Habitat: On decayed wood and bark of conifers, mosses, lichens and fungus, in ***Abies-Pinus*** forest.

Specimens studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano, 8 July, 1988, 3200 m, *GF # 121*; 13 July, 1988, 3100 m, *HC # 138; HC # 143*; 14 July, 1988, 3400 m, *RP # 182*; 3500 m, *HC # 160, RP # 158*; 31 July, 1988, 3350 m, *GF # 246; GF # 249; RP # 245*; 3450 m, *RP # 236*; 11 August, 1988, 3250 m, *GF # 347*; 12 August, 1988, 3400 m, *RP # 334*; 3500 m, *RP # 304*; 1 Sept., 1988, 3150 m, *RP # 374*; 2 Sept., 1988, 3300 m, *RP # 403; RP # 407*; 3350 m, *RP # 391*; 15 Sept., 1988, 3300 m, *RP # 498*; 3500 m, *RP # 423*; *RP # 430*; 16 Sept., 1988, 3150 m, *RP # 526*; 3100 m, *HC # 628*; 3200 m, *RP # 508*; 27 sept., 1988, 3300 m, *RP # 616; RP # 617*; 3450 m, *RP # 596*; 3500 m, *RP # 549; RP # 552*; 04 Nov., 1988, 3300 m, *RP # 684; RP # 689*; 26 Nov., 1988, 3250 m, *GF # 795; GF # 803*; 3300 m, *RP # 772*; 3350 m, *GF # 827*; 19 Dec., 1988, 3300 m, *RP # 840*; 20 Jan., 1989, 3100 m, *RP # 927*; 10 March, 1989, 3400 m, *RP # 971*; 07 Jul., 1989, 3450 m, *RP # 1071*; 21 Jul., 1989, 3350 m, *GF # 1711*; 18 August., 1989, 3250 m, *GF # 1760*; 3350 m, *GF # 1763, GF # 1764*; 31 August., 1989, 3300 m, *RP # 1189*; 3350 m, *GF # 1118*; 20 Oct., 1989, 3250 m, *GF # 458*; 11 Jan., 1990, 3250 m, *GF # 1230*; 3300 m, *RP # 1349; RP # 1357*; 3500 m, *RP # 1414*; 09 Feb., 1990, 3300 m, *RP # 1460*; 3350 m, *HC # 1734*; 3500 m, *RP # 1497*; 09 March, 1990, *RP # 1556*; 19 May, 1990, 3450 m, *RP # 1742*; 3500 m, *RP # 1759*; 13 Jun., 1990, 3350 m, *GF # 1564; GF # 1565*. Rancho Escondido, Tlaxco Municipality, 30 August., 1989, *GF # 1080*.

Observations: ***Stemonitis splendens*** is a highly variable species, ranging from 5 mm to 25 mm in length, with a polygonal and fine or very open mesh, from (10-)20 μm to 100(-125) μm,; with dark colors, from black to dark purplish brown, or sometimes reddish brown when the spores have dispersed (Martin & Alexopoulos, 1969; Farr, 1976; Lakhanpal & Mukerji, 1981). In its typical expression it forms crowded sporangia growing on a silvery hypothallus, making its determination easy.

The Mexican specimens do not have the typical silvery hypothallus of the species and many of them are small and sometimes have expansions in the capillitium and the apex of the columella. These features point to ***S. flavogenita*** Jahn, however, ***S. splendens*** can also have membranous expansions in the capillitium (Martin & Alexopoulos, 1969). When this happens, the separation of the two species can be based on the smaller size of the mesh and the paler color and more delicate ornamentation of the spores of ***S. flavogenita*** (Martin & Alexopoulos, 1969). Nevertheless, in our specimens, all of the combinations between sporangium size, mesh size, columella expansion and kind of ornamentation can be found, i.e. large sporangia with a small and delicate mesh, expanded columella and either strong or delicate ornamentation of the spores, or small sporangia with open mesh, sometimes with expansions in the columella and spores either strongly or faintly marked.

Lakhanpal & Mukerji (1981) considered ***S. splendens*** a variable species in its habit, height of the sporangia and epispore, and they have delimited it because of its metallic iridescence, the attenuate coiled columella, and its small superficial mesh. In some of the specimens from Tlaxcala, we find iridescent sporangia, but this feature is not constant. On the other hand, Stojanowska (1983) and Bersan (1990) considered that ***S. splendens*** develops on different kinds of substratum, while ***S. flavogenita*** grows predominantly on litter, and they pointed out that the morphological characteristics are more constant in the latter species.

We think that the specimens from the Malintzin Volcano belong to two or more species which are difficult to separate using only morphological features. We prefer to consider all of them ***S. splendens*** until techniques are developed to distinguish the species of this complex.

Lamproderma columbinum (Pers.) Rost.

Habitat: On leaves of liverworts and mosses ***Symblepharis vaginata*** (Hook) Wijk & Morgan, ***Campylopus fragilis*** (Brid.) BSG and ***Brachithecium*** sp., in ***Abies-Pinus*** forest.

Specimens studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzi Volcano, 27 May, 1988, ***GF # 28; GF # 37; GF # 39***; 23 June, 1988, ***RP # 41***; 27 June, 1988, ***RP # 61***; 12 August, 1988, 3450 m, ***GF # 379***; 16 Sept., 1988, 3250 m, ***GF # 579***; ***HC # 567; HC # 578; HC # 583***; 27 Sept., 1988, 3250 m, ***HC # 755; HC # 757***; 28 Sept., 1988, 3250 m, ***HC 743; HC # 747***; 4 Nov., 1988, 3250 m, ***GF # 731; GF # 736***; 3450 m, ***HC # 819***; 26 Nov., 1988, 3250 m, ***GF # 805; GF # 806***; 19 Dec., 1988, 3250 m, ***GF # 866; GF # 869***; 20 Jan., 1989, 3250 m, ***GF # 911***; 10 Feb., 1989, 3250 m, ***GF # 939***; 10 March, 1989, 3400 m, ***HC # 1340***; 21 April, 1989, 3250 m, ***GF # 1018; GF # 1020; HC # 1367***; 20 Oct., 1989, 3250 m, ***HC # 1519; HC # 1554***; 11 Jan., 1990, 3250 m, ***GF # 993; GF # 1241; GF # 1248; HC # 1602; HC # 1604***; 3300 m, ***GF # 1256***; 9 Feb., 1990, 3250 m, ***GF # 1334; GF # 1335***; 9 March, 1990, 3250 m, ***HC # 1784; HC # 1789; HC # 1800; HC # 1822; HC # 1823; HC # 1826***; 23 March, 1990, 3250 m, ***GF # 1428; GF # 1435; GF # 1439***; 19 April, 1990, 3250 m, ***GF # 1488; GF # 1498***; 13 June, 1990, 3450 m, ***RP # 1789***.

Observations: The distinctive features of this species are the long stalks up to 4 mm, and the brown or smokey color, the spinose or verruculose ornamentation and the size (from 10 to 14 μm) of the spores. The Mexican specimens match the description of Martin & Alexopoulos (1969), except in the larger spores (10-18 μm). ***Lamproderma columbinum*** is very close to ***L. echinulatum*** (Berk.) Rost., but can be distinguished by its larger spores and the longer spines (up to 1.5 μm). ***Lamproderma nigrisplendidum*** Poelt was described from Nepal (Kowalski, 1970), and is similar to ***L. columbinum*** except in the size of the spores (14-17 μm). Nevertheless, ***L. nigrisplendidum*** is known only from the type collection and it has been considered to be a large-spored form of ***L. columbinum*** (Kowalski, 1970). If it is a good species, then the specimens from Tlaxcala agree with ***L. nigrisplendidum*** because of the size of their spores.

Lamproderma scintillans (Berk & Br.) Morgan

Habitat: On dead leaves of angiosperms in a riparian mixed hardwood forest.

Specimens studied: Yauquemehcan Municipality, Atlihuetzia Falls, 4 August, 1988, ***HC # 283***; 5 August, 1988, ***HC # 288; RP # 251; RP # 264***; 20 July, 1989, ***RP # 1076***.

Comatricha laxa Rost.

Habitat: On decayed wood of conifers and mosses, in ***Abies-Pinus*** forest.

Specimens studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzi Volcano, 16 Sept., 1988, 3200 m, ***HC # 604; HC # 596***; 28 Sept., 1988, 3200 m, ***HC # 764; HC # 770***; 04 Nov., 1988, 3500 m, ***HC # 805***; 19 Dec., 1988, 3500 m, ***HC # 999***; 19 May, 1989, 3200 m, ***HC # 1384***; 27 Sept, 1989, 3500 m, ***HC # 686; HC # 687***; 20 Oct., 1989, 3250 m, ***GF # 1161***; 3500 m, ***HC # 1582***; 09 March, 1989, 3150 m, ***RP # 1559***; 23 March, 1990, 3400 m, ***HC # 1361; HC # 1923***; 3500 m, ***HC # 478***; 19 April, 1990, 3250 m, ***GF # 1497***.

Observations: In its typical expression, this species has very distinctive reddish ovate sporangia. However, ***C. laxa*** is a highly variable species in size, form of the sporangia and length of the stalks. Härkönen & Uotila (1983) indicated that the presence of horizontal primary branches is a very useful feature for distinguishing this species. The specimens from the Malintzin Volcano are also highly variable but most of our specimens have conspicuous horizontal primary branches.

Comatricha aff. ***lurida*** Lister

Sporangia gregarious, stalked, globose, up to 1 mm in total height and 0.3 mm in diameter; peridium evanescent; stalk black, cylindrical but wider at the base, shining; hypothallus reduced; columella black, short, reaching half way into the sporangium and divided apically into stout branches from which the capillitium arises, with membranous expansions between the branches of the columella; capillitium semi-open, anastomosed, dark brown, with blunt free ends; spores dark brown in mass, violaceous brown by transmitted light, globose, verrucose, 10 - 11 µm in diameter.

Habitat: On decayed coniferous wood, in *Abies-Pinus* forest.

Specimen studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano, 30 July, 1988, 3100 m, *HC # 216*.

Observations: The specimen studied is very close to *C. lurida*, however, it has membranous expansions between the branches of the columella, the free ends of its capillitium are concolorous, and the spores are slightly larger.

C. elegans (Racib.) Lister has a similar branching columella but differs in having a short columella divided near the base of the sporangium.

Martin & Alexopoulos (1969) and Farr (1976) considered that there may be variants connecting *C. lurida* and *C. elegans* and their differences may only be the expression of two extreme forms. The Mexican specimen may be one of these variants, but the presence of membranous expansions in the columella separates it from those two species. Similar expansions are found also in *C. aggregata* Farr, but this species forms very crowded groups of sporangia forming pseudoethalia, and it has a persistent peridium.

Comatricha nigra (Pers.) Schroet.

Habitat: Mainly on dead wood, but also on bark, in *Abies-Pinus* forest.

Specimens studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano, 3 July, 1988, 3500 m, *HC # 268*; 8 July, 1988, 3250 m, *HC # 122*; 31 July, 1988, 3350 m, *HC # 231*; 3500 m, *HC # 233*; 31 August, 1988, 3350 m, *HC # 1451*; 1 Sept., 1988, 3150 m, *RP # 370*; 3500 m, *HC # 486*; 15 Sept., 1988, 3500 m, *HC # 1873*; 16 Sept., 1988, 3100 m, *GF # 593*; 4 Nov., 1988, 3350 m, *GF # 707*; 3500 m, *RP # 736*; 10 March, 1989, 3350 m, *RP # 973*; 21 April, 1989, 3500 m, *HC # 1925*; 20 Oct., 1989, 3350 m, *HC # 1506; GF # 1169*; 3400 m, *HC # 1583*; 11 Jan., 1990, 3300 m, *RP # 1331; RP # 1382*; 9 Feb., 1990, 3100 m, *RP # 1423*; 3300 m, *RP # 1450*; 3500 m, *GF # 1403*; 9 March, 1990, *RP # 1545; RP # 1555*; 19 April, 1990, 3450 m, *RP # 1713*.

Comatricha rubens A. List.

≡***Collaria rubens*** (A. List.) Nann.-Brem.

Sporangia scattered to gregarious, up to 1 mm in total height, globose to obovate, 0.3-0.5 mm in diameter, pinkish brown; hypothallus membranous, fragile, dark reddish, forming a disk at the base of each individual sporangium; stalk black, shining, cylindrical, approximately half the total height; evanescent peridium except at the base of the sporangium where it persists as a collar; columella reaching to the center of the sporangium, rigid, blunt; capillitium open, arising along the length of the columella, bright brown in transmitted light, formed by almost parallel threads, with free, acute and paler ends; spores pinkish brown in the mass, pale brown by transmitted light, globose, spinulose, 7 - 8 µm in diameter.

Habitat: On dead stems of herbaceous plants, in ***Abies-Pinus*** forest.

Specimen studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano. 11 Jan., 1990, 3350 m, ***RP # 1384***.

Observations: The pinkish color and the remains of the capillitium forming a collar are the diagnostic features of this species. Farr (1976) stated that it is unknown from the tropics; however, she found a comparable specimen from Mendoza, Argentina, which has smooth and slightly larger spores. Nannenga-Bremekamp (1991) treated this species in the genus ***Collaria***.

Comatricha subcaespitosa Peck

≡***Stemonitopsis subcaespitosa*** (Peck) Nann.-Brem.

Figs. 4H-I.

Habitat: On burned wood of conifers, in ***Abies-Pinus*** forest.

Specimen studied: STATE OF TLAXCALA: Ixtenco Municipality, east slope of the Malintzin Volcano, 28 Sept., 1988, 3150 m, ***RP # 645***; 26 Nov, 1988, 3250 m, ***RP # 758***; 20 Jan, 1989, 3500 m, ***RP # 882***; 9 Feb., 1990, 3250 m, ***RP # 1439***; 3350 m, ***RP # 1467***; 3400 m, ***RP # 1478***; 3500 m, ***GF # 1412***; 23 March, 1990, 3450 m, ***RP # 1630***; 3500, ***RP # 1648***; 13 Jun., 1990, 3400 m, ***RP # 1780***.

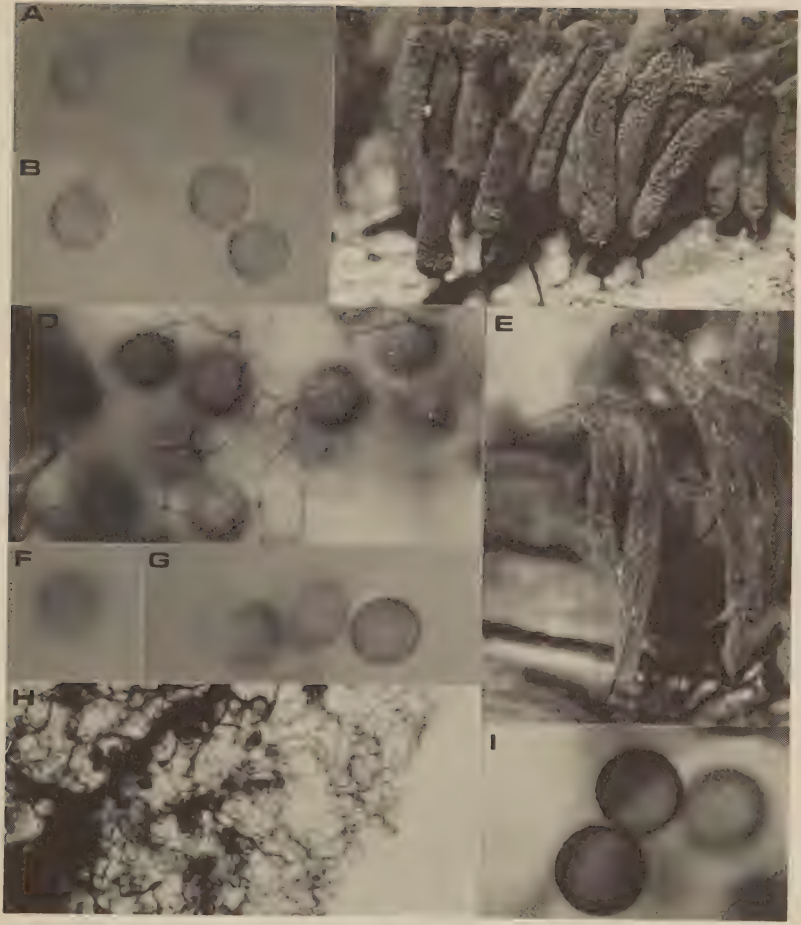


Fig. 4. A-B. ***Stemonitis hyperopta*** (*RP*-127). A. Spores in surface view (Nomarski Interference Contrast: NIC X 1100); B. Spores in optical section (NIC X 1100). C-D ***Stemonitis nigrescens*** (*RP*- 1757); C. Sporangia (X 8.8); D. Spores (NIC X 1100). E-G. ***Stemonitis pallida*** (*RP*-490); E. Sporangia (X 13.2); F. Spores in surface view (NIC X 1100); G. Spores in optical section (NIC X 1100). H-I. ***Comatricha subcaespitosa*** (*RP*-758); H. Superficial net of the sporangia (X 110); I. Spores (NIC X 1100).

Observations: Our specimens agree with descriptions of Martin & Alexopoulos (1969) and Nannenga-Bremekamp (1991) (as *Stemonitopsis subcaespitosa*) except in the color of the hypothallus, being reddish brown and not silvery as those workers indicated. Nevertheless, the evident membranous expansions in the internal net, the almost complete with angular meshes of the surface net (Fig. 4H) and the warted spores (Fig. 4I) distinguish this species from others in the genus. Superficially, *Comatricha subcaespitosa* looks like a species of *Stemonitis* because of its almost complete peripheral net, but it can be distinguished from members of that genus by the structure of its stalk which is solid and fibrous.

Comatricha tenerrima (Curt.) List.

Habitat: On dead wood of angiosperms and stems of herbaceous plants, in *Pinus- Quercus* forest and riparian mixed hardwood forest.

Specimens studied: STATE OF TLAXCALA: Totolac Municipality, Tepeticpac Hill, 26 July, 1991, *HC # 1996*. Yauquemehcan Municipality, Atlihuetzia Falls, 4 August, 1988, *HC # 282*.

DISCUSSION

Both families of Stemonitales recognized by Martin *et al*. (1983) and Nannenga-Bremekamp (1991), were represented in the State of Tlaxcala: Schenellaceae and Stemonitaceae. Species found in this geographical area belong to nine of the 16 genera of Stemonitales (Nannenga-Bremekamp, 1991). *Stemonitis* and *Comatricha* are the most frequently collected genera and have the highest number of species. On the other hand, *Schenella, Colloderma, Diacheopsis, Collaria* and *Enerthenema* were represented each by only one species. Also, it is important to emphasize the infrequency of the genus *Lamproderma*, with only two species in the state, and only one in the main area of study. All of the recorded species in this paper were previously unknown to Tlaxcala State, three species for the Neotropics and two species for Mexico.

The species of Stemonitales from Tlaxcala represent around 12.3 % of the total number of known species of this Order (Nannenga-Bremekamp, 1991), and around 58.3 % of the known Stemonitales from Mexico (Trujillo, 1988; Ogata *et al.*, 1994). We add two genera of Myxomycetes previously unrecorded from Mexico: ***Schenella*** and ***Diacheopsis*** (Braun & Keller, 1986; Ogata *et al.*, 1994). Now 45 of the 59 known genera of Myxomycetes are recorded from Mexico. Braun and Keller (1986) listed 164 species of Myxomycetes collected from Mexico up to 1986. Since that date, 39 taxa have been added to that list (Trujillo *et al.*, 1986; Trujillo, 1988; Villarreal, 1990; Hernández Cuevas *et al.*, 1991; Ogata *et al.*, 1994), including the taxa recorded in this paper. The number of recorded species from Mexico is now 203 which is about 33.8 % of the 600 described taxa of Myxomycetes (Nannenga-Bremekamp, 1991).

ACKNOWLEDGEMENTS

We wish to thank Mr. D. W. Mitchell, Dr. H. W Keller, Mr. K. L. Braun and Dr. C. Ladó for revising this manuscript. Mr. D.W. Mitchell and Mrs. Nannenga-Bremekamp helped identify some of our specimens.

LITERATURE CITED

Acosta, R. & A. Kong, 1991. ***Guía de las excursiones botánicas y micológicas al cerro de El Peñon y Cañada Grande del estado de Tlaxcala.*** IV Congreso Nacional de Micología. Universidad Autónoma de Tlaxcala, Sociedad Mexicana de Micología y Jardín Botánico de Tizatlán. Tlaxcala. 82 pp.

Bersan, F., 1990. Il genere ***Stemonitis*** Roth (Myxomycetes; Stemonitomicetidae) in Italia. ***AMB. 33***:210-216.

Braun, K. L. & H. W. Keller, 1976. Myxomycetes of Mexico I. ***Mycotaxon 3***:297-317.

Braun, K. L. & H. W. Keller, 1986. Myxomycetes of Mexico III. ***Rev. Mex. Mic. 2***:25-39

CETENAL, 1975 A. ***Carta edafológica, Tlaxcala, 1:250000.*** S.P.P., México, D.F.

CETENAL, 1975 B. ***Carta climática, Tlaxcala, 1:250000.*** S.P.P., México, D.F.

Farr, M. L., 1976. ***Myxomycetes. in: Flora Neotropica.*** The New York Botanical Garden. Nueva York. 304 pp.

Galindo, F. G., 1992. ***Algunos hongos del Jardín Botánico Tizatlán***, Gobierno del estado de Tlaxcala.

Härkönen, M. & P. Uotila, 1983. Turkish myxomycetes developed in moist chamber cultures. ***Karst. 23***:1-9.

Hernández-Cuevas, L., M. Rodríguez-Palma, G. Galindo-Flores & A. Estrada-Torres, 1991. New records of myxomycetes from Mexico. ***Mycotaxon 62***:17-27.

Keller, H. W. & K. L. Braun, 1977. Myxomycetes of Mexico II. ***Bol. Soc. Mex. Mic. 11***:163-180.

Kowalski, D. T., 1970. The species of ***Lamproderma***. ***Mycologia 62***:621-672.

Kowalski, D. T., 1975. The genus ***Diacheopsis***. ***Mycologia 67***:616-628.

Lakhanpal, T. N. & K. G. Mukerji, 1981. ***Taxonomy of Indian Myxomycetes***. Cramer. Voduz, 531 pp.

López A., L. Villarreal & A. Sosa., 1981. Estudio sobre los myxomycetes del estado de Veracruz, III. ***Bol. Soc. Mex. Mic. 16***:77-93.

Martin, G. W. & C. J. Alexopoulos, 1969. ***The Myxomycetes***. Univ. Iowa. Academic. Press. Iowa City, 561 pp.

Martin, G. W., C. J. Alexopoulos & M. L. Farr. 1983. ***The Genera of Myxomycetes***. Univ. Iowa. Academic. Press. Iowa City, 102 pp.

Mitchell, D. W., 1995. ***Synkey*** [Synoptic key to all described Myxomycetes for IBM Personal Computer].

Moreno, G., C. Illiana & M. Heykoop., 1989. Contribution to the study of the Myxomycetes in Spain I. ***Mycotaxon 34***: 623-635.

Munsell, 1992. ***Munsell soil colour charts***. Kollmorgen Corporation, Baltimore.

Nannenga-Bremekamp, N. E., 1991. ***A guide to temperate Myxomycetes***. Biopress. Bristol. 409 pp.

Ogata, A., D. Nestel, V. Rico-Gray & G. Guzman., 1994. Los Myxomycetes citados de Mexico. ***Acta Bot. Mex. 27***:39-51.

Stojanowska, W., 1983. Myxomycetes of the litter. ***Acta Mycol. 19***:21-30.

Trujillo, F. I., 1988. Contribución al conocimiento de los myxomycetes de la Sierra de Manatlán, Jalisco. ***Tiempos de Ciencia. 12***:20-27.

Trujillo, F. I., M. M. Castañeda & L. Guzmán-Dávalos, 1986. Hongos del estado de Jalisco, IV. Los myxomycetes conocidos. ***Tiempos de Ciencia 5***:42-51.

Villareal, L. 1990. Estudio sobre los myxomycetes de Mexico I. Nuevos registros. ***Mycol. Neotrop. Apl. 3***:67-79.

MYCOTAXON

Volume LX, pp. 103-110 October-December 1996

STUDIES ON MEDITERRANEAN HYPHOMYCETES. III. *QUADRACAEA MEDITERRANEA* ANAM.-GEN. AND SP. NOV.

LUNGHINI D., PINZARI F. AND ZUCCONI L.*

Laboratorio di Micologia, Dipartimento di Biologia Vegetale,
Largo Cristina di Svezia 24, I-00165 Roma, Italy
** Dipartimento di Scienze Ambientali, Via San Camillo de Lellis,*
I-01100 Viterbo, Italy

Abstract

Quadracaea mediterranea anam.-gen. et sp. nov., an hyphomycete recorded on leaves of *Quercus ilex* L. from central Italy, is described, discussed and illustrated, also by means of SEM.

Keywords: Hyphomycetes, *Quadracaea mediterranea*, *Endophragmiella*, *Selenosporella*, Italy, new genus

During mycological studies carried out in different sites of central Italy, characterized by Mediterranean shrubby vegetation (Lunghini, 1994, 1995; Zucconi *et al*., 1995), an interesting fungus (dematiaceous Hyphomycete) was collected on *Quercus ilex* L. leaf litter.

Quadracaea anam.-gen. nov.

[Etym.: dedicated to the memory of the mycologist Livio Quadraccia (1958-1993), University "La Sapienza" of Rome]

Coloniae *effusae. Mycelium partim superficiale, partim immersum, ex hyphis septatis ramosisque compositum. Hyphopodiis nullis.* Conidiophora *macronemata, mononemata, erecta, septata, crassitunicata.* Cellulae conidiogenae *integratae, terminales, postea intercalares, polyblasticae, cellulas separantes acropleurogenas producentes. Subsequentes cellulae conidiogenae proliferatione percurrente oriuntur ex*

septo basilari cellulae terminalis. Cellulae separantes ampulliformes, ad apicem post rhexolyticam secessionem conidiorum apertae, vacuae. Conidia blastica, solitaria, cicatrice basilari margine fimbriata praedita. Species typica: Quadracaea mediterranea *anam.-sp. nov.*

Colonies on natural substratum effuse. Mycelium superficial or immersed, composed of branched, septate hyphae. Hyphopodia absent. Conidiophores macronematous, mononematous, straight, septate, thick-walled. Conidiogenous cells integrated, terminal, becoming intercalary, polyblastically producing acropleurogenous groups of separating cells. Successive percurrent proliferations occur at the basal septum of the terminal separating cell into and beyond it. Separating cells ampulliform, with an open end appearing empty after rhexolytic conidial secession. Conidia blastic, solitary, bearing a frill at the base.

Quadracaea mediterranea anam.-sp. nov. (Fig. 1)

Coloniae amphigenae, effusae, brunneae usque ad atro-brunneae, pilosae. Mycelium partim superficiale, partim in substrato immersum, a luteo ad brunneum, ex hyphis septatis, ramosis, levibus, usque ad 4 µm latis, ad conidiophororum basim inflatis compositum. Conidiophora solitaria vel (3-4) fasciculata, recta vel flexuosa, levia, luteo-brunnea, sursum pallidiora, ad basim lobatam 6-11.5 µm lata, usque ad 250 µm longa et in parte inferiore 4-7 µm lata, cellulas separantes in partibus variis ferentia. Cellulae conidiogenae integratae, terminales, deinde intercalares post percurrentem proliferationem, subcylindricae, 5.7-9 x 3.6-5 µm, colore conidiophoris similes, polyblasticae, cellulas separantes proferentes. Cellulae separantes acropleurogenae, simplices vel usque ad 7 verticillatae, ampulliformes, apicem versus attenuatae, post rhexolyticam secessionem conidii apertae, vacuae, tenuitunicatae, leves, pallide brunneae, 4.5-6.7 x 3.5-4.4 µm. Raro ramus e latere per proliferationem percurrentem emergens. Conidia solitaria, sicca, subovata ad obpiriformia, 3-(raro 4-) septis transversalibus praedita, modice ad septa constricta, 20-28.5 x 8.2-12 µm; cellula basilaris fere crassitunicata, levis, dilute brunnea, cicatrice basilari margine fimbriata praedita; secunda et tertia cellulae valde crassitunicatae, leves (paulo asperata si SEM observantur), atro-brunneae, secunda cellula reliquis amplior et obscurior; cellula apicalis tenuitunicata, levis, subhyalina, emergentia subconica apicali praedita, quae phialoconidia gignere potest; phialoconidia fusiformia, leviter falcata, aseptata, hyalina, Selenosporellae *similia, 5.5-8.8 x 0.8-1.2 µm.*

In foliis emortuis Quercus ilicis *L., in loco "Riomarina", in Insula Elbae (Prov. Livorno, in Italia), legit D. Lunghini, 8.IV.1989, IMI 367816, holotypus.*

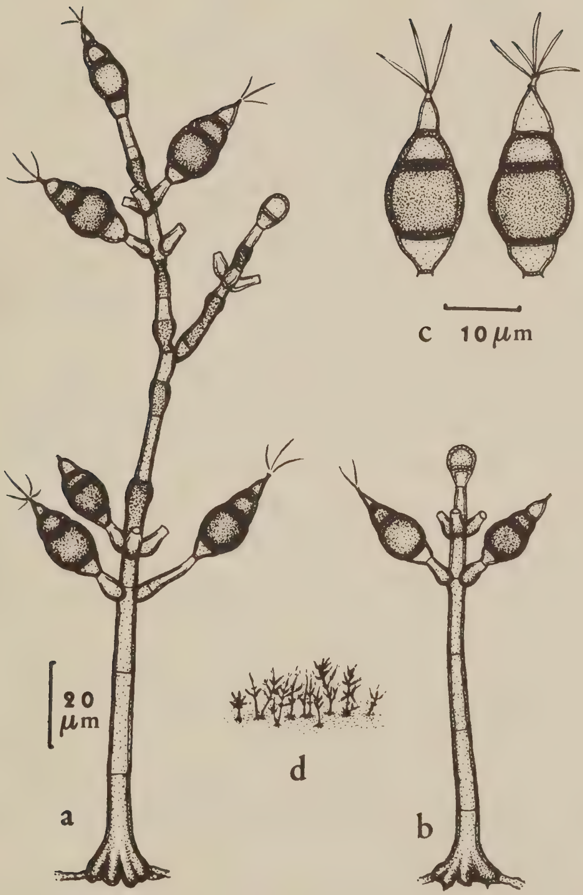

c 10 µm
20 µm
a
b
c
d

Fig. 1. *Quadracaea mediterranea*: a and b, mature and young conidiophores; c, detail of conidia; d, colony on its natural substratum.

Colonies amphigenous, effuse, dark brown to blackish brown, hairy. Mycelium partly superficial, partly immersed in the substratum, composed of branched, smooth, septate, light brown or yellowish brown, up to 4 µm wide hyphae, swollen near the conidiophore origin. Conidiophores arising singly or in small groups (3-4), straight or flexuous, smooth, dark yellowish brown, paler towards the apex, with a lobate base measuring 6-11.5 µm in width, up to 250 µm long and 4-7 µm wide near the base, bearing separating cells at different levels. Conidiogenous cells subcylindrical, 5.7-9 x 3.6-5 µm, concolorous with the conidiophore, polyblastic, producing apical and lateral separating cells, integrated, terminal, becoming intercalary by percurrent proliferations which arise by an extension of the basal septum of the apical separating cell into and beyond it. Separating cells acropleurogenous, simple or in clusters when numerous (up to 7), ampulliform, tapered at the apex, empty, leaving an open end after the rhexolytic conidial secession, thin-walled, smooth, pale brown, 4.5-6.7 x 3.5-4.4 µm. Rarely, an occasional lateral percurrent proliferation may produce a lateral branch. Conidia solitary, dry, suboval to obpyriform, 3-(rarely 4-) transversely septate, slightly constricted at the septa, 20-28.5 x 8-12 µm; basal cell slightly thick-walled, smooth, pale brown, bearing a conspicuous frill at the base; second and third cells very thick-walled, smooth at the light microscope (finely roughened under SEM), very dark brown, the second broader and darker than the others; apical cell thin-walled, smooth, subhyaline, bearing a subconical elongation which can produce phialoconidia. Synanamorphic phialoconidia fusiform, slightly falcate, aseptate, hyaline, produced in a *Selenosporella*-like pattern, 5.5-8.8 x 0.8-1.2 µm. An attempt to obtain this species in pure culture was unsuccessful. No ascocarps of a possible teleomorph were found.

Other material examined: on a leaf litter of *Quercus ilex* L., at "San Liberato" (Terni, Italy), legit D. Lunghini, 29.IV.1993, IMI 367817, *paratypus*; on leaf litter of *Q. ilex*, at "Macchiagrande" (Focene, Rome), legit F. Pinzari, 23.XI.1992, ROHB 181, *paratypus*; on leaf litter of *Q. ilex*, at "Cala Martina" near Follonica (Grosseto, Italy), legit L. Zucconi, 18.X.1993, ROHB 179, *paratypus*; on leaf litter of *Q. ilex*, at "Alma" (Grosseto, Italy), legit L. Zucconi, 18.X.1993, ROHB 180, *paratypus*.

Quadracaea can be distinguished from other similar hyphomycete genera by the combination of polyblastic conidiogenous cells, each producing more ampulliform separating cells, rhexolytic conidial secession and apical percurrent proliferation.

Conidial production and percurrent proliferation (Fig. 2) are similar with those of *Endophragmiella boewei* (Crane) S. Hughes (1979). In *Quadracaea* the septa at the base of the separating cells are formed after those at the base of the conidia at a time when the maturing conidia become pigmented. This process leads to the appearance of verticillate pigmented empty cells, which we prefer to call separating cells while

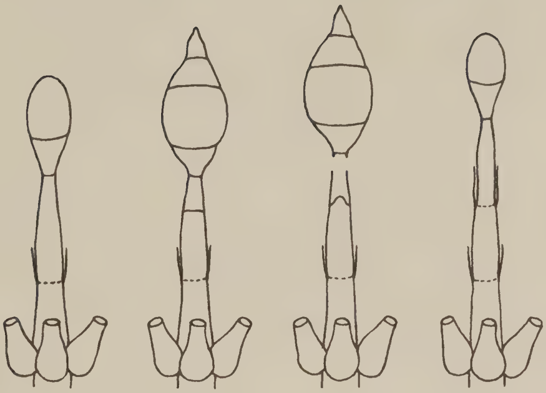


Fig. 2. *Quadracaea mediterranea*. Diagrammatic representation of delimitation of separating cell, conidium secession and origin of percurrent proliferation from terminal conidiogenous cell.

reserving the term conidiogenous cells to the cells of one level below. They are comparable to the "terminal cells" described by Hughes (1979) for *E. boewei*. The conidiogenous cells are therefore integrated in the main axis of the conidiophore. They produce separating cells polyblastically, the first one apically and the successive ones laterally. Lateral separating cells, generally in clusters, are produced near the basal septum of the apical separating cell (acropleurogenously) and only occasionally at lower levels. Rarely, branches are produced by percurrent proliferations through lateral separating cells.

The verticillate disposition of the separating cells observed in *Quadracaea* superficially resembles that of branches and conidiogenous cells in *Physalidiopsis* Castañeda & Kendrick (1990). However, according to Castañeda (*pers. comm.*), the conidiophores in *Physalidiopsis* are definitely branched and the conidia are stauroconidia. Lateral branches are also present in the apparently similar *Endophragmiella verticillata* S. Hughes (1978).

Quadracaea has, in common with the above reported genera, the occurrence of synanamorphic *Selenosporella*-like phialoconidia.

Figs 3 and 4 show photographs of *Q. mediterranea* by light and scanning electron microscopy. The polyblastic conidiogenous cells produce

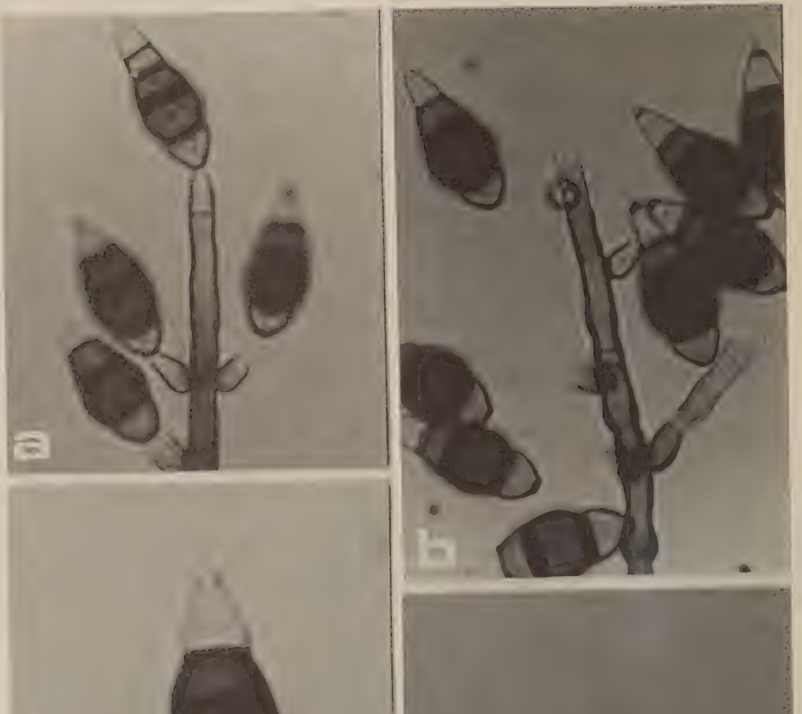


Fig. 3. *Quadracaea mediterranea*: a and c, conidia and conidiophore apex (a x 850; c x 1600); b, lateral production of branches (x 950); d, conidium with basal frill and apical synanamorphic phialoconidia (x 1900).

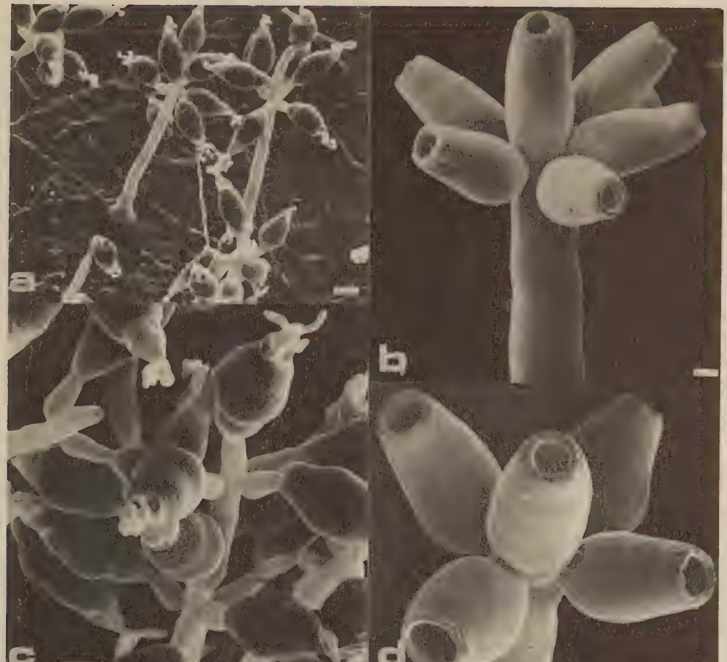


Fig. 4. *Quadracaea mediterranea*: a, conidiophores on the leaf surface (bar = 10 µm); b and d, polyblastic conidiogenous cells and empty separating cells (bar = 1 µm); c and g, conidia and separating cells (c, bar = 5 µm; g, bar = 1 µm); e and f, synanamorphic phialoconidial production at the conidial apex (bar = 1 µm).

several ampulliform separating cells (Fig. 4 b, d), which leave an open end after rhexolytic conidial secession and appear empty (Fig. 4 d, g). Up to seven separating cells disposed in a cluster have been observed, but the complexity of the fertile region could probably be influenced by environmental and nutritional conditions. Percurrent proliferation occurs through the apical separating cell (Fig. 3 a-c) and this mode of conidiogenesis can be repeated several times. Rarely proliferation near the basal septum (Fig. 3 b) or occasionally inside lateral separating cells (Fig. 1 a) may produce a branch. Conidia generally remain attached to the separating cells and the result of successive proliferations is a complex structure (Fig. 4 c). Conidia are smooth-walled when observed under the light microscope (Fig. 3 a-d), but the two central cells are found to be lightly roughened under SEM (Fig. 4 c); they are provided with a frill at the closed base due to rhexolytic liberation (Fig. 4 g).

Detached conidia still connected with the separating cells at the base have occasionally been observed.

The authors wish to thank Prof. Walter Gams, Dr Rafael Castañeda Ruiz and Prof. Silvano Onofri for kindly reviewing the manuscript and the Museo Provinciale di Storia Naturale (Livorno) for the invaluable cooperation offered. This research was supported by a grant from M.U.R.S.T. (Ministero dell'Università e della Ricerca Scientifica e Tecnologica).

References

Castañeda Ruiz, R.F. & Kendrick, B. (1990). Conidial fungi from Cuba: I. *Univ. Waterloo Biol. Ser.* 32: 53 pp.

Hughes, S.J. (1978). *Endophragmiella verticillata.* Fungi Canadenses No. 130.

Hughes, S.J. (1979). Relocation of species of *Endophragmia* auct. with notes on relevant generic names. *N. Z. J. Bot.* 17: 139-188.

Lunghini, D. (1994). *Menispora convoluta*, a new dematiaceous Hyphomycete from central Italy. *Mycotaxon* 50: 429-433.

Lunghini, D. (1995). Studi sugli Ifomiceti mediterranei. II. Ifomiceti Demaziacei dell'Isola d'Elba (Livorno). Nota preliminare. *Quaderni Mus. St. Nat. Livorno* (in press).

Zucconi, L., Facchin, M. & Perini, C. (1995). Microfungal communities in Mediterranean evergreen forests (Central Italy). *Bocconea* (in press).

MYCOTAXON

Volume LX, pp. 111-123 October-December 1996

HETEROBASIDIOMYCETES FROM MAJORCA & CABRERA
(Balearic Islands)

PETER ROBERTS

The Herbarium, Royal Botanic Gardens, Kew, Surrey, TW9 3AE, England
E-mail: P.Roberts@rbgkew.org.uk

Seven species of the Platygloeales, Tremellales, and Tulasnellales are described and illustrated. The mycoparasitic genus *Spiculogloea*, provisionally assigned to the Platygloeales, is described as new, based on the new species *Spiculogloea occulta*. *Tulasnella balearica* is described as new. *Basidiodendron nodosum*, *B. rimulentum*, *Ceratosebacina longispora*, *Sebacina epigaea*, and *Serendipita vermifera* are described and illustrated. Eleven additional heterobasidiomycete species, all from Majorca, are documented.

A number of new and unusual heterobasidiomycetes were collected during the British Mycological Society's 1992 Overseas Foray to the Mediterranean islands of Majorca and Cabrera, part of the Balearic group lying off the east coast of Spain.

The foray, held in November, was based at Port de Pollença on the north-east coast of Majorca, with most collecting undertaken in the adjacent coastal strip and in the highlands of the Serra de Tramuntana (*ca* 500-1200 m). A single short visit was made to the small island of Cabrera some 10 km south of Majorca. Despite previous rain, weather during the foray was rather dry so that few of the more conspicous heterobasidiomycetes were in evidence, most collections being from fallen wood and other material in damp litter.

New and less common collections are described in detail below, followed by a checklist of additional heterobasidiomycetes collected during the foray.

PLATYGLOEALES

Spiculogloea P. Roberts gen. nov.

Basidiomata nulla, in hymeniis fungorum parasitica. *Hyphae* angustae, in typo generis fibulatae, haustoria tremelloidea ferentes. *Basidia* cylindracea, transeptata, e probasidiis exorientia; plus minusve crassitunicata, cyanophila, subtiliter spiculata vel granulata. *Conidia* in typo generis oblonga vel subcylindrica, e conidiophoris simplicibus exorientia. *Sporae* in typo generis fusiformes.

Typus generis: *Spiculogloea occulta*

Basidiome within the hymenium of the host; not visible to the naked eye. *Hyphae* narrow, clamped in the type species, connected to the host hyphae by tendril-like haustorial cells, similar to those found in the genus *Tremella* Pers. *Basidia* tubular, laterally septate, arising from probasidia; both probasidia and basidia somewhat thick-walled, cyanophilous, and covered with fine spicules or granules. *Conidia* ellipsoid in the type species, arising in clusters on simple conidiophores produced alongside the basidia. *Spores* fusiform in the type species.

The new genus *Spiculogloea* is distinguished by its parasitic, intrahymenial habit, the presence of *Tremella*-like haustorial cells, and the curious, cyanophilous, finely spiculate or granular basidia arising apically from small probasidia. A second, much smaller, narrow-spored species has been found in England as a parasite of resupinate heterobasidiomycetes.

Two other auricularioid genera are known to possess similar haustorial cells: *Occultifur* Oberw. and *Zygogloea* P. Roberts. The former is a parasite of *Dacrymyces* Nees: Fr., and has smooth, thin-walled basidia which do not arise from probasidia. The latter is a parasite of *Myxarium nucleatum* Wallr., has coiled basidia lacking probasidia, and produces distinctive 'twinned' zygoconidia. Neither closely resembles the new genus, *Spiculogloea*.

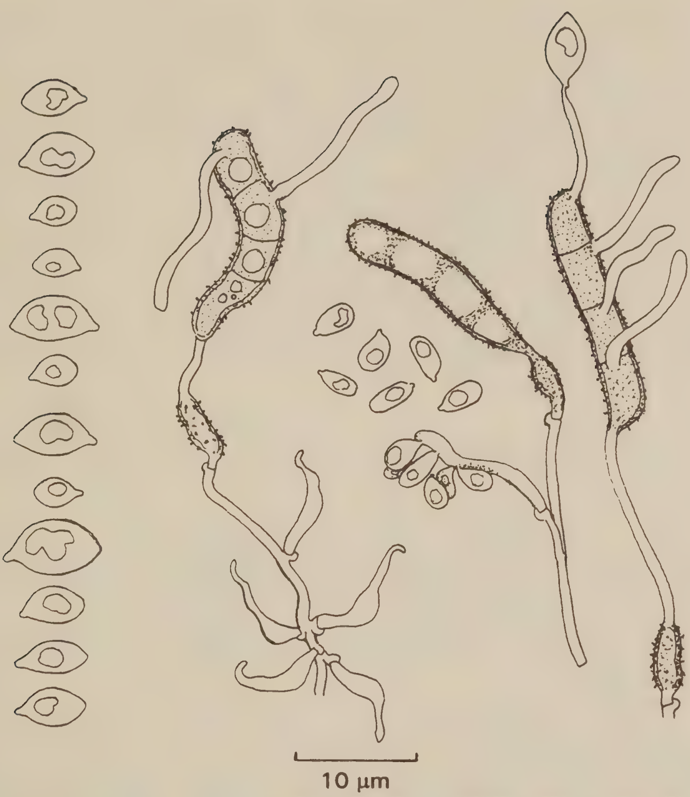


Fig. 1. ***Spiculogloea occulta:*** *basidiospores from print; basidia showing haustorial cells, conidiophore and conidia, and swollen probasidia* [**K(M) 28706**; holotype]

Spiculogloea occulta P. Roberts sp. nov.

(Fig. 1)

Basidiomata nulla, in hymeniis Corticiacearum parasitica. *Hyphae* angustae, 0.5-1.5 µm latae, fibulatae, haustoria tremelloidea ferentes. *Basidia* cylindracea, transeptata, stipitata, usque 40 µm longa, e probasidiis parvis exorientia; plus minusve crassitunicata, cyanophila, subtiliter spiculata vel granulata. *Conidia* oblonga vel subcylindrica, 3.5-5.0 x 2.0-2.5 µm, e conidiophoris simplicibus exorientia. *Sporae* fusiformes, 3.5-7.5(-8.0) x 2.5-4.5(-5.0) µm.

In hymenio *Hyphodermatis argillacei*, Son Moragues, Majorca, Balearicae Insulae, 11 Nov. 1992, P. Roberts 576, holotypus, **K(M) 28706**.

Basidiomes none, parasitic in the hymenium of resupinate, corticioid fungi. *Hyphae* clamped, rather thin, 0.5-1.5 µm wide. Haustorial cells, subtended from clamp-connexions, arising singly or in clusters from the hyphae. *Basidia* auricularioid, 4-celled, laterally septate, arising apically, often on a distinct stalk of variable length, from small, clavate probasidia which are clamped at the base; total length up to 45 µm. Basidia and probasidia somewhat thick-walled, cyanophilous, and covered in fine spicules or granulations. *Sterigmata* sinuous, up to 15 µm long, the sterigma of the apical cell arising laterally. *Conidia* formed laterally, in clusters, on simple tubular or weakly clavate conidiophores arising from basidia-bearing hyphae; individual conidia apiculate, oblong to subcylindrical, 3.5-5.0 x 2.0-2.5 µm. *Basidiospores* widely fusiform, 3.5-7.5(-8.5) x 2.5-4.0(-5.0) µm from print, occasionally producing secondary spores. Germination not seen.

Specimen examined: in hymenium of *Hyphoderma argillaceum* (Bres.) Donk on fallen wood, Son Moragues, Majorca, 11 Nov. 1992, P. Roberts 576, holotype, **K(M) 28706**.

The common auricularioid parasite of corticioid fungi is *Colacogloea peniophorae* (Bourdot & Galzin) Oberw. & Bandoni, normally found on or in *Hyphoderma praetermissum* (P. Karst.) J. Erikss. & A. Strid. *C. peniophorae* can easily be distinguished from *Spiculogloea occulta* by its smooth basidia, lack of haustorial cells, and ventrally flattened, subellipsoid spores.

Whether *Spiculogloea occulta* is host specific is one of many questions still to be answered. It is hoped that this initial description may encourage corticiologists to specifically search for this and other interesting hymenial parasites. They may be a more common and diverse group than the comparatively few records suggest.

TREMELLALES

Basidiodendron nodosum Luck-Allen. *Can. J. Bot.* 41: 1045 (1963) (Fig. 2)

Basidiomes thin, effused, ceraceous, pale grey. *Hyphae* narrow, agglutinated, and closely adhering to the substrate. *Basidia* 2-4 celled, globose to ellipsoid, *ca* 8-15 µm wide, tending to arise acropetally on the sub-basidial hyphae, but not conspicuously so (compared to *B. rimulentum* below). *Sterigmata* rather short, narrowing from base to tip. *Cystidia*

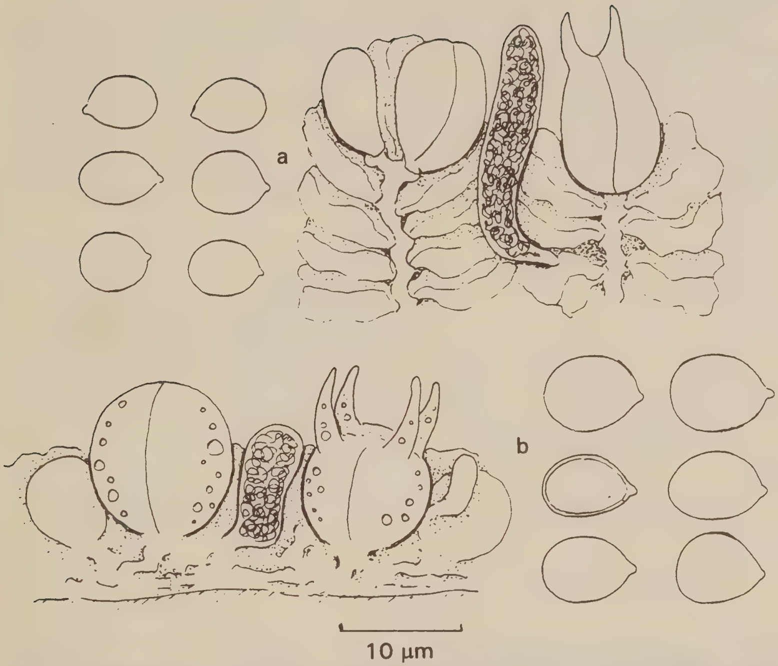


Fig. 2. ***Basidiodendron nodosum****: a) basidiospores from print, basidia and cystidium* **[K(M) 28708]***; b)* **[K(M) 28707]**

tubular with lateral basal stalk; length variable, but normally equal to the depth of the hymenium; not or barely projecting; some hyaline, most with highly refractive, cyanophilous, yellowish-brown contents. *Spores* broadly ellipsoid (Q = 1.1-1.4), 6.0-8.0 x 5.0-6.5 µm (Roberts 623); 8.0-9.0 x 6.5-7.0 µm (Roberts 583) from prints.

Specimens examined: on woody remains of *Agave* (?), Port de Pollença, Majorca, 12 Nov. 1992, P. Roberts 583, **K(M) 28707**; on fallen twig, probably *Erica multiflora*, Cabrera, 15 Nov. 1992, P. Roberts 623, **K(M) 28708**.

Basidiodendron nodosum does not appear to have been reported from Europe before, though it is not uncommon in southern England and is probably widespread throughout the continent. Collections from the former Soviet Union with similar, broadly ellipsoid spores were referred by Wells & Raitviir (1975) to *B. cinereum* (Bres.) Luck-Allen, a closely related taxon differing only (if at all) in its longer, ellipsoid or oblong spores.

The Canadian type collection of *B. nodosum* (on decayed *Pinus*, Little White River, Ontario, 14 Sep. 1956, R.F. Cain, **TRTC 33408**) has spores of almost identical size and shape to the Cabrera collection cited above. The Majorcan collection has slightly larger spores and rather larger, more globose basidia, but is within the degree of variation seen in British collections. The species, in common with the genus as a whole, appears to be litter-inhabiting without any noticeable substrate preferences.

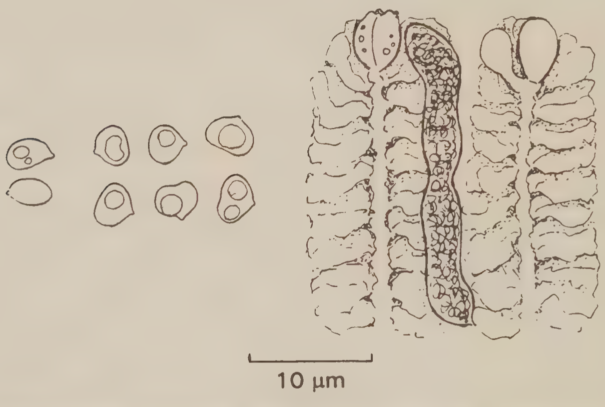


Fig. 3. ***Basidiodendron rimulentum:*** *basidiospores from print, basidia and cystidium* **[K(M) 28709]**

Basidiodendron rimulentum (Bourdot & Galzin) Luck-Allen.

Can. J. Bot. 41:1037 (1963) (Fig. 3)

Basidiome thin, effused, ceraceous, pale grey. *Hyphae* narrow, agglutinated, closely adhering to the substrate. *Basidia* 4-celled, rather small, *ca* 3.5-4.0 µm wide, arising acropetally on conspicuous, well-defined, sub-basidial stalks. *Sterigmata* short. *Cystidia* tubular, similar to those of *B. nodosum* above. *Spores* appearing ellipsoid in side view, reniform or heart-shaped from above or below, 3.0-3.5(-4.0) x 3.5-5.0 µm from print.

Specimen examined: on fallen twig, probably *Erica multiflora*, Cabrera, 15 Nov. 1992, P. Roberts 624, **K(M) 28709.**

Basidiodendron rimulentum is a widespread but uncommon species, very similar to *B. eyrei* (Wakef.) Luck-Allen which differs in having more conventional, globose spores. Both species have well-developed and conspicuous basidial 'stalks' on which the basidia are produced in succession. In larger-spored species, such as *B. nodosum* above, these stalks are much less well-defined.

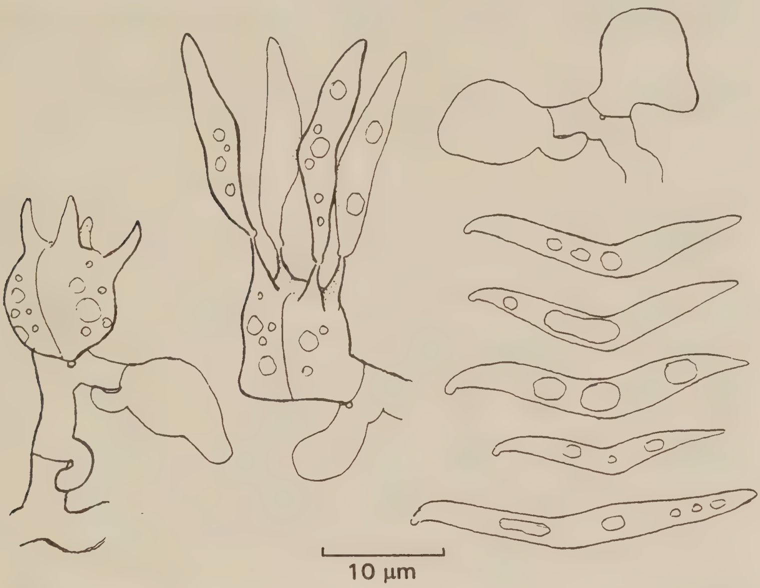


Fig. 4. ***Ceratosebacina longispora:*** *basidia and basidiospores* **[K(M) 26202]**

Ceratosebacina longispora (Hauerslev) P. Roberts.

Mycological Research 97: 470 (1993) (Fig. 4)

Basidiome not visible to the naked eye in this specimen; when visible, thin, effused, ceraceous, greyish. *Hyphae* clamped, *ca* 2.5-4.0 µm wide, not appearing gelatinized, forming a loose, irregular hymenium similar to that seen in species of *Ceratobasidium* D.P. Rogers. *Hyphidia* absent. *Basidia* 2-4 celled, subglobose to ellipsoid, *ca* 10 µm wide, but often appearing cuboid or snouted as a result of short hyphal outgrowths. *Sterigmata* in this and the majority of specimens consistently short, wider at the base than the apex. *Spores* elongated, narrowing at each end, obtusely angled at mid-point, 23-33 x 2.5-3.0(-3.5) µm from print.

Specimen examined: on fallen wood, Son Moragues, Majorca, 11 Nov. 1992, P. Roberts 574, **K(M) 26202**.

This inconspicuous but distinctive species has recently been redescribed by Roberts (1993) from a number of British collections. The type collection is from Denmark and specimens have been seen from Belgium, France, and Norway, suggesting *C. longispora* is widespread in Europe.

Sebacina epigaea (Berk. & Broome) Neuhoff. *Zeitschrift für Pilzkunde* 15(3): 71 (1931) (Fig. 5)

Basidiomes at first pustular, subgelatinous, greyish blue; then coalescing and appearing tuberculate, becoming ceraceous and opaque; finally encrusting, uneven to smooth, subcartilaginous, greyish to ochraceous, up to 10 cm or so across. *Hyphae* unclamped, *ca* 2.0-4.0 µm wide, in a gelatinous context, basal hyphae becoming somewhat thick-walled and cyanophilous. *Hyphidia* weakly branched, forming a layer above the basidia. *Basidia* 4-celled. subglobose to ellipsoid, often somewhat stalked and occasionally myxarioid. *Sterigmata* sinuous, extending indefinitely to the hymenial surface. *Spores* ellipsoid, 9.0-12.0 x 6.0-7.0 µm (D. Jefferies, Cabrera); 11.5-13.0 x 9.0-11.0 µm (Roberts 559); 11.5-15.5 x 8.5-12.0 µm (Roberts 558), from prints. *Resting spores* formed from primary or secondary basidiospores, the spore content shrinking into a thick-walled, refractive, cyanophilous central section, sometimes leaving the outer remnants of the spore as hyaline, thin-walled projections.

Specimens examined: encrusting surface of half-buried wood, Menut, Majorca, 10 Nov. 1992, P. Roberts 558, **K(M) 26231**; same date and location, on damp compacted earth, P. Roberts 559, **K(M) 26242**; encrusting fallen wood and litter, Cabrera, D. Jefferies, 15 Nov. 1992, **K(M) 26822**.

Sebacina epigaea is a common, but seldom described species, with a preference for growing on damp, compacted earth. In such fruit bodies, the hymenium is non-geotropic, a feature shared with other species of *Sebacina* Tul. *sensu stricto*.

The appearance of the fruit body changes markedly with age (see description above). Furthermore the number and appearance of the resting spores, a distinguishing feature of *Sebacina epigaea*, also seem to change with age. In young fruit bodies (such as the Cabrera specimen) they are normally sparse or absent, and appear to be derived entirely from primary basidiospores. The spore contents shrink into a concentrated, refractive, cyanophilous central section delimited by thickened walls; the outer part of the spore simply collapses, so that the resting spore appears rather angular. In older fruit bodies, the number of resting spores increases, and most are derived from secondary spores. These are often highly irregular, sometimes becoming stellate, with numerous hyaline projections. Often the empty shell of the primary basidiospore (or at least the connecting sterigma) remains attached. Very old fruit bodies have been found which only contain resting spores, with no functional basidia remaining.

The two Majorca specimens cited above have a high proportion of unusually large basidiospores, but otherwise appear typical.

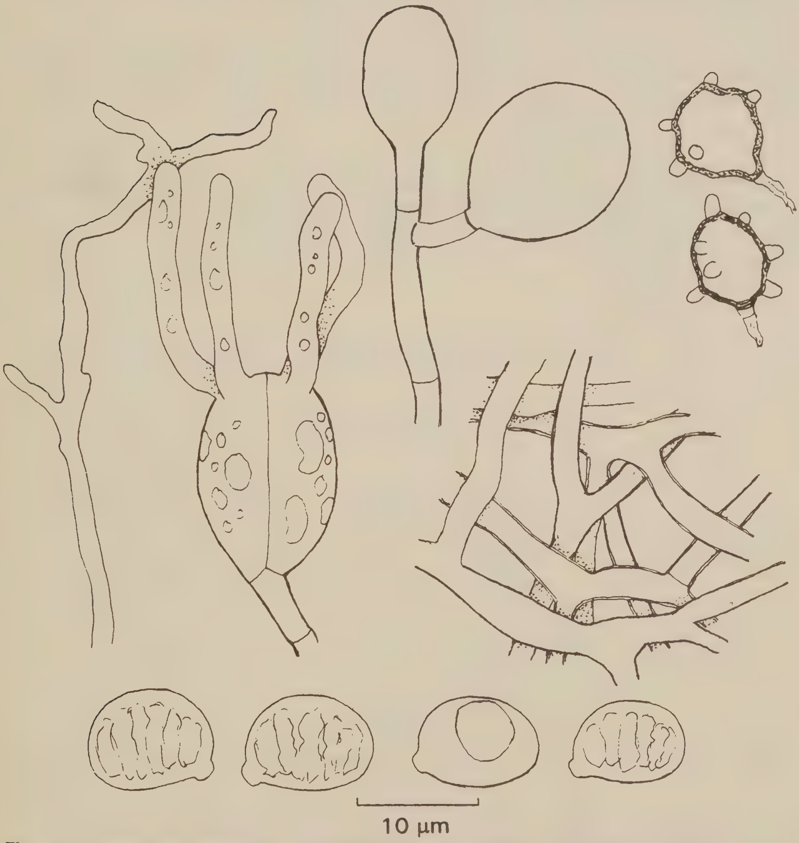


Fig. 5. ***Sebacina epigaea:*** *hyphidium and basidia; nodulose resting spores; unclamped hyphae in context; basidiospores from print* **[K(M) 26242]**

Serendipita vermifera (Oberw.) P. Roberts, *Mycological Research* 97: 474 (1993) (Fig. 6)

Basidiome not macroscopically visible. *Hyphae ca* 1.0-2.0 µm wide, not forming an hymenium but trailing loosely over the substrate; septa not seen. *Basidia* 2-4 celled, subglobose to ellipsoid, *ca* 6.0 µm wide, arising in clusters of 3-5 at intervals along the hyphae. *Sterigmata* very variable, often branching off subsidiary sterigmata. *Spores* vermiform, straight or slightly sinuous, 36-50 x 1.5-2.5 µm from print.

Specimen examined: on fallen wood, with or near *Botryobasidium isabellinum* (Fr.) D.P. Rogers, Bosc de Monnaber, Majorca, 13 Nov. 1992, P. Roberts 587, **K(M) 26201**.

Oberwinkler (1963) originally described the species with scattered clamp connexions, but Warcup & Talbot (1967), studying cultured isolates from orchid roots, could find none. British collections appear unclamped (Roberts, 1993).

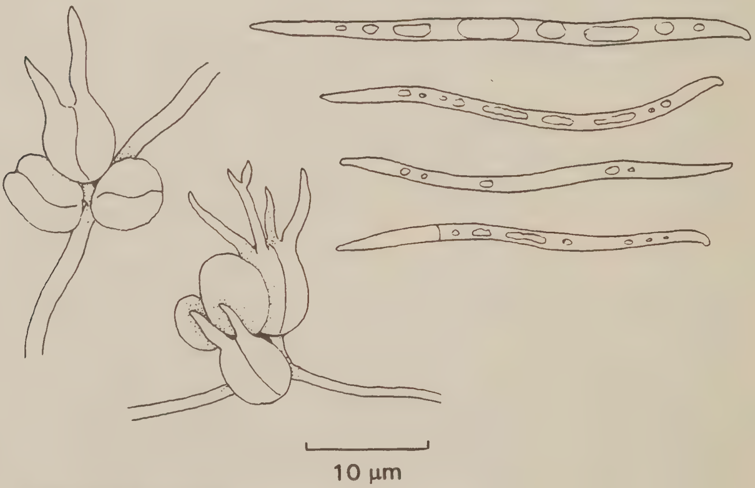


Fig. 6: ***Serendipita vermifera***: *clustered basidia; basidiospores from print* **[K(M) 26201]**

TULASNELLALES

Tulasnella balearica P. Roberts sp. nov. (Fig. 7)

Basidiomata effusa, ceracea, violaceogrisea. *Hyphae* non fibulatae, *ca* 3.0-4.0(-6.0) µm latae. *Basidia* clavata, *ca* 5.5-6.5 µm lata. *Sterigmata* 4, ellipsoideae vel fusiformes. *Sporae* angustae, 9.0-20.0(-26.5) x 2.5-3.0(-3.5) µm (Q = 3.0-9.0).

In spica dejecta *Zeae mayis*, Binifaldo, Majorca, Balearicae Insulae, 10 Nov. 1992, P. Roberts 565, holotypus, **K(M) 28705**

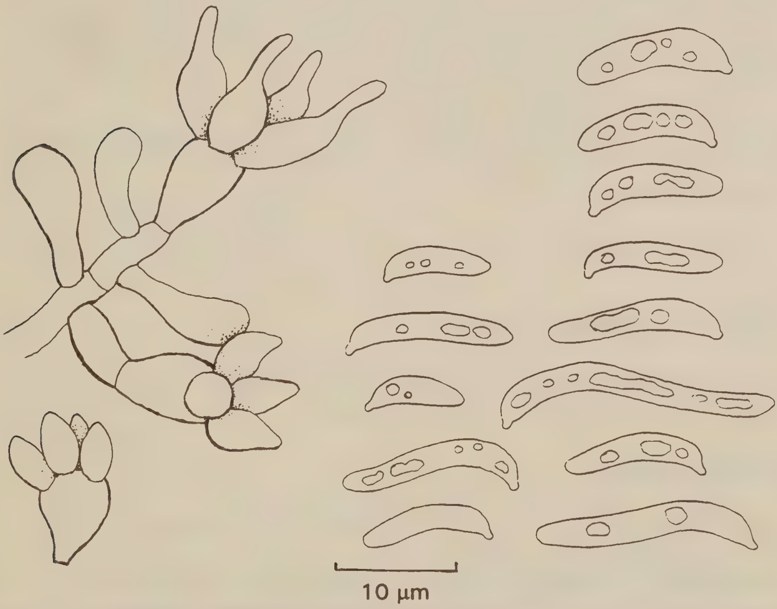


Fig. 7: ***Tulasnella balearica:*** *basidia; basidiospores from print* **[K(M) 28705;** **holotype]**

Basidiomes effused, thin, ceraceous, violaceous-grey. *Hyphae* unclamped, conventionally branched, *ca* 3.0-4.0 µm wide, occasionally swollen up to 6.0 µm wide in the hymenium. *Basidia* clavate, *ca* 5.5-6.5 µm wide. *Sterigmata* 4, ellipsoid becoming mitriform to fusiform. *Spores* narrow, depressed or somewhat sinuous, 9.0-20.0(-26.5) x 2.5-3.0(-3.5) µm from print (Q = 3.0-9.0).

Specimen examined: on discarded ear of *Zea mays* on woodland path, Binifaldo, Majorca, 10 Nov. 1992, P. Roberts 565, holotype, **K(M) 28705**

Though based on a single collection, the narrow, elongated spores of *T. balearica* are distinctive and unlike any other *Tulasnella* species yet described. *T. pallidocremea* Jülich has equally narrow but much shorter spores (*ca* 10-12 µm long) and substantially larger basidia. *T. deliquescens* (Juel) Juel also has narrow spores, but they are consistently longer (*ca* 25-50 µm) and of a different, vermiform shape. *T. calospora* (Boudier) Bourdot & Galzin and *T. brinkmannii* Bres. have spores of approximately the right length, but fusiform and substantially wider (at least 3.5-5.0 µm across).

The type specimen's unusual substrate (a discarded ear of maize found on a damp woodland path) is unlikely to be of consequence, since most if not all *Tulasnella* species appear to be litter saprotrophs without host preferences.

Additional species collected

All the following collections are from Majorca. The Kew herbarium number is given where specimens have been retained.

Dacrymycetales

Calocera cornea (Batsch: Fr.) Fr. on fallen twig, Bosc de Monnaber, 13 Nov.1992, P.C. Holland

Dacrymyces enatus (Berk. & M.A. Curtis) Massee, on fallen ?*Quercus* branch, Bosc de Monnaber, 13 Nov. 1992, C.S.V. Yeates, **K(M) 26215**

Dacrymyces stillatus Nees: Fr., on fallen branch of *Quercus* cf. *ilex*, Menut, 10 Nov. 1992, P. Roberts; same substrate, Bosc de Monnaber, 13 Nov. 1992, P. Roberts

Platygloeales

Helicogloea lagerheimii Pat., on fallen wood, Bosc de Monnaber, 13 Nov. 1992, P. Roberts 590, **K(M) 26196**

Tremellales

Eichleriella deglubens (Berk. & Broome) D.A. Reid, on partly fallen branch, Binifaldo, 10 Nov. 1992, P. Roberts 572, **K(M) 29745**

Exidiopsis effusa (Bref. ex Sacc.) Möller, on fallen wood, Binifaldo, 10 Nov. 1992, P. Roberts 570, **K(M) 26809**

Myxarium nucleatum Wallr., on fallen wood, Menut, 10 Nov. 1992, P. Roberts 557, **K(M) 30617**; on fallen branch, Binifaldo, 10 Nov. 1992, P. Roberts; on fallen twig, Formentor, 14 Nov. 1992, P. Roberts.

Tremella foliacea Pers.: Fr. on fallen branch of *Quercus* cf. *ilex*, Bosc de Monnaber, 13 Nov.1992, A. Henrici, **K(M) 29999**

Tremella mesenterica Retz.: Fr., on fallen branch of *Quercus* cf. *ilex*, Bosc de Monnaber, 13 Nov.1992, P. Roberts

Tulasnellales

Tulasnella pallida Bres., Bosc de Monnaber, 13 Nov. 1992, P. Roberts 585, **K(M) 26146**

Tulasnella violea (Quélet) Bourdot & Galzin , Bosc de Monnaber, 13 Nov. 1992, P. Roberts 588, **K(M) 26154**

Thanks to Dr J. Ginns for kindly reviewing this paper.

REFERENCES

Oberwinkler, F. (1963) Niedere Basidiomyceten aus Südbayern III. *Ber. bayer. bot. Ges*. 36: 41-55

Roberts, P. (1993) *Exidiopsis* species from Devon, including the new segregate genera *Ceratosebacina*, *Endoperplexa*, *Microsebacina*, and *Serendipita*. *Mycol. Res*. 97: 467-478

Warcup, J.H. & Talbot, P.H.B. (1967) Perfect states of Rhizoctonias associated with orchids. *New Phytologist* 66: 631-641

Wells, K. & Raitviir, A. (1975) The species of *Bourdotia* & *Basidiodendron* of the USSR. *Mycologia* 67: 904-922

MYCOTAXON

Volume LX, pp. 125-128 October-December 1996

A NEW SPECIES OF CALLISTOSPORIUM

Raymond M. Fatto
1187 Millstone River Road
Somerville, NJ 08876-4726

Alan E. Bessette
Biology Department
Utica College of Syracuse University
1600 Burrstone Road
Utica, NY 13502

SUMMARY

Collections of a species of *Callistosporium* did not match published macroscopic descriptions of *Callistosporium luteo-olivaceum*. A new species, *Callistosporium purpureomarginatum* is described.

INTRODUCTION

A collybioid fungus found repeatedly while conducting a fungal inventory at Rutgers University's Hutcheson Memorial Forest, Somerset Co., NJ, was recorded as *Callistosporium luteo-olivaceum* (Berk.& Curt.) Singer primarily because of its microscopic features. Disturbingly, the macroscopic features and habitat did not conform with the literature description. When this same taxon was found at the 1994 NAMA Foray at Montreat, NC, the species name "*rubescentifolia*" was suggested. A literature search disclosed that *Collybia colera var. rubescentifolia* (Pk.) Pk. had been synonymized (Bigelow and Barr, 1966; Redhead, 1982) with *Callistosporium luteo-olivaceum* and Peck's (1886) original macroscopic description and habitat did not equate with that of the taxon in question. Since published descriptions do not satisfactorily portray this taxon, it is here described as a new species.

MATERIALS AND METHODS

Color terms and designations used in the following descriptions are cited from Maerz & Paul (1930) when designated as M&P 4J6 or from the ISCC-NBS system (Kelly & Judd, 1955) when of the form, number, modifier, hue, e.g., 15 moderate red, otherwise they reflect the authors' color concept. Microscopic descriptions were made from sections mounted in water, 3% KOH and Melzer's solution. Unless indicated otherwise, the specimens examined from NJ are deposited in the herbarium of the New Jersey Mycological Association at Rutgers University, New Brunswick, NJ.

TAXONOMY

Callistosporium purpureomarginatum Fatto & Bessette sp. nov.

Pileus 10-45 mm latus, primo convexus ad marginem incurvatum tum late convexus-paene planus, saepe aliquantum umbiliciformis, margo excedens lamellas, glaber si humidus, ab fusco rubello-purpureo usque ad brunescentem-violaceum, hygrophanus, discus mox luteolus-tannus usque ad roseolum-tannum sed in margine retinens fuscus brunescens-violaceus. Contextus tenuis, pallidus-luteolus-tannus. Odor indistinctus. Sapor leviter amerus, cum sapore metallico post aliquantum temporis. Lamellae adnexae vel emarginatae, confertae, roseolae vel luteae cum purpureo tinctu supra, marginatae rubellae-purpureae. Stipes 10-40 mm longus, 1.5-4 mm crassus, glaber, concolorus cum lamellis, basis cum tomento albo vel cremeo. Basidiosporae 5-7 x 3-4.5 mm, formae grani mali vel ellipticae, glabrae, inamyloideae. Cheilocystisia filiformis.

Holotypus legit Fatto 8-8-95, a R. M. Fatto lectus, in ligniis quercus cariosis, prope Hutcheson Memorial Forest, Rutgers University, NJ, USA. 8 August 1995. in herb. New York Botanical Garden conservatus.

Pileus (10-)15-30(-45) mm broad, convex with an incurved margin when young, expanding to nearly plane, often subumbilicate, margin exceeding lamellae; surface glabrous when young and moist to slightly radially fibrillose when dry, dark reddish purple to brownish violet, M&P 7H6 to 6K10 or 7J1 to 6G10 or approximately 16 dark red to 46 grayish reddish brown when young and moist, hygrophanous, disc soon drying to a yellowish tan, M&P 12J4 to 13H6 or 90 grayish yellow, and then fading to a pinkish tan, M&P 4A9 to 12D5 or approximately 76 light yellowish brown from the disc towards the margin but retaining a dark brownish violet band at the margin, band usually sharply delineated, 1-3 mm wide, the portion of the margin exceeding lamellae very fragile, becoming blackish violet, when dried uniformly M&P 7A10 or 61 grayish brown exclusive of the blackish marginal band; **context** thin, to 1 mm, pale yellowish tan; **odor** pleasant but not distinctive; **taste** slightly bitter with a metallic aftertaste.

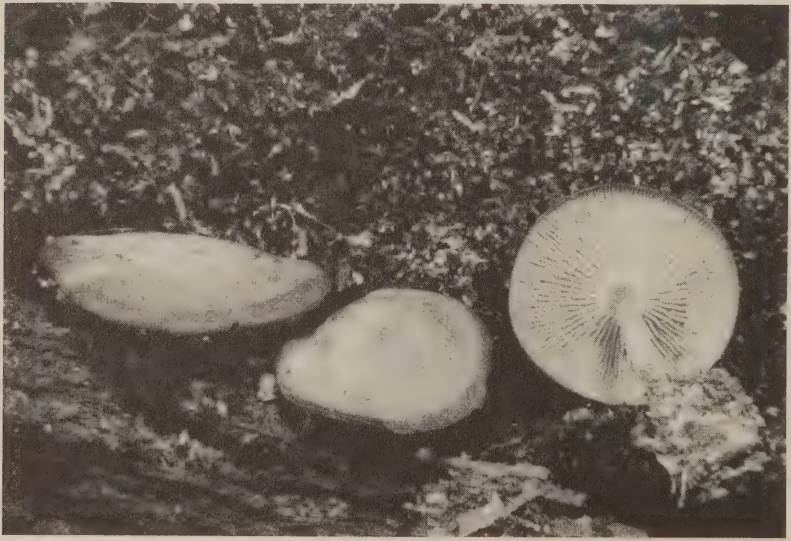


Fig. 1. Basidiocarps of *Callistosporium purpureomarginatum* (Fatto) x 1.5

Lamellae adnexed to emarginate with a slightly decurrent tooth, of varying lengths, close, thin, 1.5-3 mm broad, pinkish or yellow with purple overtones, edges uneven, marginate reddish purple.

Stipe 10-40 mm long, 1.5-4 mm thick, equal, usually curved, occasionally eccentric, hollow; surface glabrous to slightly fibrillose mostly on the upper half, slightly striate, when fresh and moist concolorous with the lamella margins, hygrophanous, soon purplish brown to yellow, aging brownish, base with white to creamy tomentum.

Chemical reactions: 3% KOH on pileus quickly medium to dark brown. 10% NH_4OH on pileus no reaction to faint browning.

Spore deposit white. **Spores** 5-7 x 3-4.5 µm, pip-shaped to elliptical, smooth, inamyloid, hyaline, but in KOH, many uniguttulate with gray contents, in aged herbarium spores the globule dissipates leaving grayed particles throughout the spore. **Basidia** 17-24 x 6-8 µm, clavate, four sterigmate. **Pleurocystidia** absent. **Cheilocystidia** filamentous, 24-40 x 2-4 µm, cylindric to flexuous, apices rounded, some slightly capitellate. **Lamellar trama hyphae** subparallel, 3-10 µm wide. **Pileipellis** a layer of interwoven hyphae, cylindrical, 3-10 µm wide, with protruding end cells, 30-50 x 5-8 µm, 2-3 septate, with fine encrusting particles. **Pileal trama hyphae** interwoven, radial in orientation, cylindrical to slightly inflated, 3-12 µm wide. **Stipitipellis** a layer of vertically oriented, subparallel hyphae, 4-10 µm wide. **Clamp connections** absent in all tissues. Trama and hymenium of fresh material pale amber, pileipellis and marginate lamella edges vinaceous brown, and pileus margin strong vinaceous in water mount and remaining so, however, in KOH trama and hymenium bright greenish yellow, pileipellis olive to pale vinaceous brown, but all slowly changing to pale vinaceous, best seen when reexamined after 12 hours. All tissue of aged herbarium specimens as revived in KOH is immediately pale brownish purple to vinaceous with dark purplish gray pigment inclusions or granules, some internal, others encrusting.

Fruiting: Scattered to gregarious on well decayed oak logs; fruiting from mid July to mid September; known from New Jersey and North Carolina, the exact range is unknown.

MATERIAL EXAMINED: NEW JERSEY: Middlesex Co.: Rutgers University's Helyar Woods, 15 August 1994, E. H. Varney. Somerset Co.: Rutgers University's Hutcheson Memorial Forest, 27 August 1991, Fatto; 7 August 1992, Fatto; 31 August 1993, Fatto; 12 July 1994, Fatto; 1 August 1995, Fatto; 8 August 1995, Fatto, (holotype of *Callistosporium purpureomarginatum* Fatto & Bessette), (NY). NORTH CAROLINA: Buncombe Co.: Montreat, 4 September 1994, Bessette 9962 (NYS).

Observations: *Callistosporium purpureomarginatum* is easily distinguished by the reddish purple pileus, reddish purple marginate lamellae, the thin violet band at the pileus margin, the reddish purple stipe which quickly dries to yellow and brown and is usually curved because of growing out of the lower sides of decaying oak logs, and its collybioid stature. *Callistosporium luteo-olivaceum* is typically yellowish brown overall, with gill edges that are only occasionally reddish brown in age and grows on decaying conifer wood. *Baeospora myriadophylla* has crowded, thin, lavender gills.

Once plucked from the cool, dark, high humidity environment in which *C. purpureomarginatum* grows, the color change from reddish purple to yellowish tan occurs rapidly, usually in 2 to 3 hours. The distinguishing features then are the grayish yellowish tan pileus with a sharply delineated deep brownish violet band at the margin, pinkish to yellow lamellae with a purple margin, and a yellow-brown stipe. KOH applied to the pileus at this stage produces a deep brown color as dark as the band at the margin, whereas if applied while the specimen is fresh and moist and still reddish purple, the color merely becomes slightly deeper and browner. This brown color leaches out in a KOH mount leaving the tissue a bright greenish yellow. At both these color stages, 10% ammonium hydroxide has little effect; however, applied a day later, it produces a medium brown color. This is truly a chameleon mushroom.

ACKNOWLEDGMENTS

We thank Dr. Roy Halling of NY and Dr. John Haines of NYS for their assistance, and Alice Janick for providing the Latin description.

LITERATURE CITED

Bigelow, H. E. and M. E. Barr. 1966. Contribution to the fungus flora of northeastern North America. IV. Rhodora 68: 175-191.

Kelly, K. L. and D. B. Judd. 1955. The ISCC-NBS Method of Designating Colors and a Dictionary of Color Names. ISCC-NBS Color-Name Charts Illustrated with Centroid Colors. National Bureau of Standards Circular 553. U.S. Government Printing Office, Washington, DC. 158 pp.

Maerz, A. and M. R. Paul. 1930. A Dictionary of Color. McGraw-Hill Book Co., Inc. New York, NY. 207 pp.

Peck, C. H. 1886. Report of the state botanist. Annual Report N.Y. State Museum of Natural History 39: 30-75.

Redhead, S.A. 1982. The systematics of *Callistosporium luteo-olivaceum*. Sydowia 35: 223-235.

MYCOTAXON

Volume LX, pp. 129-136 October-December 1996

SCUTELLOSPORA CERRADENSIS: AN ORNAMENTED SPECIES IN THE GIGASPORACEAE (GLOMALES) FROM THE CERRADO REGION OF BRAZIL

JOYCE LANCE SPAIN

3899 NW Jameson Dr.
Corvallis, OR 97330

JEANNE CLAESSEN DE MIRANDA

CPAC/EMBRAPA CAIXA POSTAL 08223
PLANALTINA, D.F. BRAZIL 73301-970

ABSTRACT

A new species of arbuscular mycorrhizal fungi was found in association with plants growing in a dark red latosol in a savanna ecosystem. Pot cultures were established and observations made of papillose hyaline to sub-hyaline spores mounted in polyvinyl alcohol-lactic acid-glycerin (PVLG), water and Melzer's reagent. *Scutellospora cerradensis* was characterized by a four layered spore wall with a pigmented germination shield forming between two flexible inner walls.

RESUMO

Uma espécie nova de fungos micorrízicos arbusculares foi encontrada em associação com plantas cultivadas em um Latossolo Vermelho Escuro em um ecossistema do tipo savana. Culturas em vasos foram conduzidas e observações foram feitas em esporos papilosos e hialinos a sub-hialinos, montados em polivinil-alcool-ácido lático-glicerina (PVLG), água e reagente de Melzer. *Scutellospora cerradensis* foi caracterizada através da parede do esporo, constituída de quatro camadas, com um escudo de germinação pigmentado formado entre duas flexíveis paredes internas.

INTRODUCTION

Scutellospora cerradensis, an early accession (1984) in the collection of native arbuscular endomycorrhizae maintained at the Centro de Pesquisa Agropecuaria dos Cerrados (CPAC), was initially identified as *S. verrucosa*, a spore with similar ornamentation, size and color. A more thorough study revealed a unique spore distinguishable from *S. verrucosa* and other described species.

An innermost flexible layer of the spore wall, not previously described, is discussed. Wall descriptions are based on ontogenetic findings in the study of two *Scutellospora* species by Franke and Morton (1994). A murograph depicts wall morphology.

MATERIALS AND METHODS

Spores, recovered by wet sieving soil and roots from a pot culture, were suspended in water and cleaned by ultrasound for 30 seconds. Color determinations were made by stereomicroscope using fiber optic illumination, color temperature 3200K. Intact spores suspended in water against a black background were compared to the INVAM Color Chart (1993). Color of shields, sporophores, auxillary cells amd wall layer reactions to Melzer's reagent was assessed against a white background.

The spore wall and inner walls of numerous spores were separated in water or PVLG on a slide using a scalpel and dissecting needles. Intact spores, ruptured spores and dissected spores were mounted in PVLG, water or Melzer's reagent and examined with a compound microscope. Melzer's reagent was also diluted with PVLG or distilled water to observe the rate and intensity of histochemical responses. The species diagnosis was based on observations of ruptured and/or dissected spores with shields mounted in PVLG and magnified 1000 X. Type specimens were mounted in PVLG; unmounted spores were preserved in 5% formalin. Observations and measurements were also made of ruptured spores in water.

LATIN DIAGNOSIS

Scutellospora cerradensis Spain & Miranda sp. nov. (Figs. 1-3)

Sporae singulae in solo feruntur in apice aut circa apicem cellulae sporogenae; raro autem sporae duae feruntur a latere unis cellulae sporogenae. Sporae maturae hyalinae vel subhyalinae; senescentes, stramineae (0/0 10/0) vel pallide luteobrunneae (0/10 40/0), globosae vel obovoideum (167-) 230-363 µm X (167-) 230-363 µm, raro irregulares. In PVLG sporae tunica constituitur stratis quatuor: exteriore papilloso <1.0-1.0 µm crasso et adherente in secundo strato rigido, 1.5-2.0 µm crasso et adherente in tertio, subtiliter lamellato, 2-3 µm crasso; quarto membranaceo <0.5-1.0 µm crasso. In PVLG stratum papillosum et stratum secundum disjunguntur. Stratum quartum et stratum tertium disjunguntur, excepta conjunctione cellulae sporogenae. Murus internus primus: stratum primum 1.0 µm crassum adheret secundo 3-5 µm crasso. Murus internus secundus constituitur stratis tribus: primum <0.5-0.5 µm crassum adheret strato secundo 4-6 (-10) µm crasso, sed crassities varietur in PVLG. Stratum tertium, in quo secundum adheret, 0.5-1.0 µm crassum, et raro cum papillis rotundis <1-1.5 µm diametro. Scutellum inter murum primum et secundum formatur.

SPORES are hyaline to sub-hyaline when mature, straw (0/010/0) to a pale yellow-brown (0/10/40/0) with age; globose to ovoid, (167-) 230-363 µm X (167-) 230-363 µm, rarely irregularly shaped. Usually spores are borne singly in soil at or near apex of sporogenous cell, however, two spores are occasionally borne laterally from one sporogenous cell. Spore contents, opaque white in immature spores, become hyaline with maturity.

The spore wall consists of a weakly laminate layer surrounded by two outer layers and an inner flexible layer, generally separate from the other layers except at point of attachment to sporogenous cell. Unless observed immediately the papillose layer, <1-1 µm thick, papillae 1- 1.5 µm diam. to slightly oblong, up to 1.5 µm high, will be perceived in PVLG as a fine reticulum or simply as a roughened layer which separates from the rigid adjacent layer, 1.5-2.0 µm thick, adherent to laminate layer, 2-3(-5) µm thick. The innermost flexible layer, <0.5-1.0 µm thick, is thicker at connection to sporogenous cell. Inner wall one has an outer layer, 1 µm thick, loosely adherent to an inner layer 3-5 µm thick. Inner wall two has a very thin outer layer, <0.5 µm thick, adherent to a thick layer, 4-6 (-10) µm, over a thin, sometimes papillose (Fig. 3G), layer, 0.5-1.0 µm thick. The germination shield forms between inner walls 1 and 2.

The ornamentation on the outermost layer of the spore wall is discrete in water (Fig. 3A). The spore wall is of four layers: together layer one, with papillae <1-1 µm thick with round, 1- 1.5 µm diam., to slightly oblong up to 1.5 µm high, and layer two are approximately 1 µm thick; layer three, laminated, 2-3 µm thick; layer four, the innermost layer, 0.5-1.0 µm thick, is rarely observed. The outer layer of inner wall one, 0.5-1 µm thick, adheres to the inner layer, 2-3 µm thick. Inner wall two has three adherent layers: a middle layer, 2-4 µm thick, surrounded by an outer layer, 1-1.5 µm thick, and an innermost layer, <1 µm thick, observed as wrinkled or when sparse to more dense papillae, <1-1.5 µm diam and 1-2 µm high, are present (Fig. 3G).

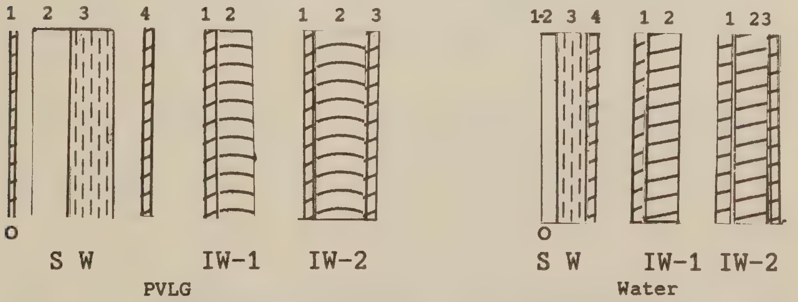


Figure 1. Murograph of *Scutellospora cerradensis*. Spore wall (SW); Inner Wall One (IW-1); Inner Wall Two(IW-2). Open: rigid single layer; vertical dashes: laminae; diagonal lines: flexible layer; hemispheres: plastic; o: ornamented layer.

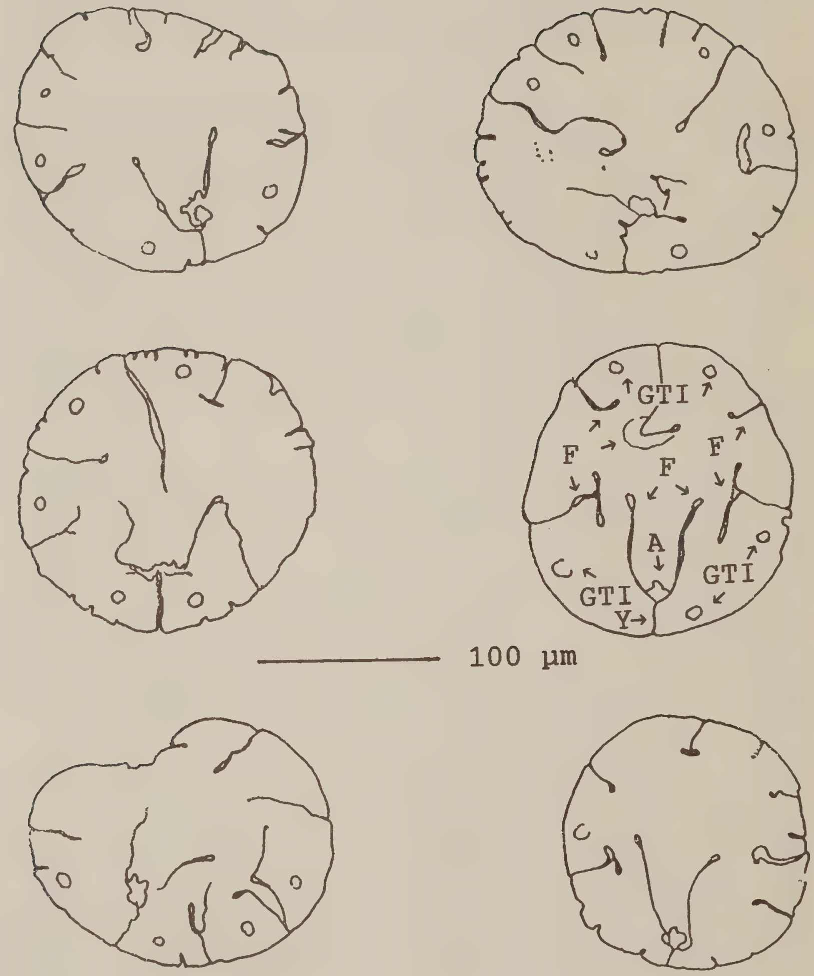

GTI
F
F
F
A
GTI
GTI
Y
100 µm

Figure 2. *Scutellospora cerradensis* germination shields, plan view; camera lucida drawings. Aperture (A); ; Germ Tube Initial (GTI); Fissure (F); 'Y' configuration around aperture (Y).

REACTION TO MELZER'S REAGENT. Five layers can be observed to react with PVLG/Melzer's reagent (1:1). The laminated layer of the spore wall is reddish yellow (INVAM 0/20 20/0) to reddish brown (20/80 60/0) and clearly distinguished from the outer two layers; the outer layer of inner wall one reacts very weakly and has a tinge of pink (INVAM 0/20 20/0) when folded on itself; the inner layer is pink (INVAM 0/60 20/0). Two layers of inner wall two are observed to react: a light pink (INVAM 0/60 20/0) outer layer over a reddish purple (INVAM 20/80 20/0) layer. In PVLG/Melzer's reagent (3:1) the innermost layer (masked by the reaction of the middle layer at a 1:1 ratio), appears to have a weak dextrinoid reaction. A differential reaction sometimes observed in the middle layer suggests that it may be, in fact, two layers.

GERMINATION SHIELD, light yellowish-brown to brown (INVAM 0/40 80/40 to 0/40 100/0), (87-)125-155 µm X (100-) 137.5-172.5 µm, forms between inner walls one and two; a 'V' or 'Y' configuration develops around aperture (Fig. 7). The largest number of germination tube loci observed was 6; the germination tube widens from a diam. of 5 µm at egress to 12.5 µm near spore.

SPOROGENOUS CELL: light yellowish brown to brown, (INVAM 0/40 80/0 to 0/40 100/0) 35-55µm X (-30)50-75µm (width by distance between apex and first septum of sporophore), often with fine hyaline hyphae coming from one to several peg-like, pigmented hyphae. Papillae are often observed on the innermost layer. A single spore usually develops at apex, however, two spores, generally with a disparity in size, occasionally emerge laterally from a single sporogenous cell. The sporophore is septate and rarely branched (Spain et al., 1989).

AUXILIARY CELLS 20-33 µm diam, smooth, round to knobby, formed in soil on yellowish brown to brown (INVAM 0/40 80/0 to 0/40 100/0) coiled or straight hyphae 3.5-4 µm diam, wall <1µm thick.

MYCORRHIZAL ASSOCIATIONS. Known to associate and develop arbuscules with *Allium porrum*, *Stylosanthes guyanensis* var. vulgaris cv Mineirão and *Sorghum bicolor* L. Moench, host plants for pot culture.

DISTRIBUTION AND HABITAT: Spore known from experimental fields at CPAC/EMBRAPA, Planaltina, D.F. Brazil; 15^{O}35'33" south; 47^{O}42'30" west; 1100 m altitude. This accession was isolated from a dark red latisol (mostly clayey) with poor phosphorus availability. Soil analyses: pH (water 1:2.5):4.8-5.0; phosphorus (ug/g soil): 3.5; aluminum (me/100 g soil): 0.2; calcium + magnesium (me/100 g soil)3.5; potassium (ug/g soil):40. Vegetation at the collection site progressed from predominantly native grasses to pasture to soybeans. A fallow period of about five years was followed by a planting of different legumes for green manure. The isolate was recovered from plots cultivated with *Tephrosia candida*, however, an association with that plant has not been determined.

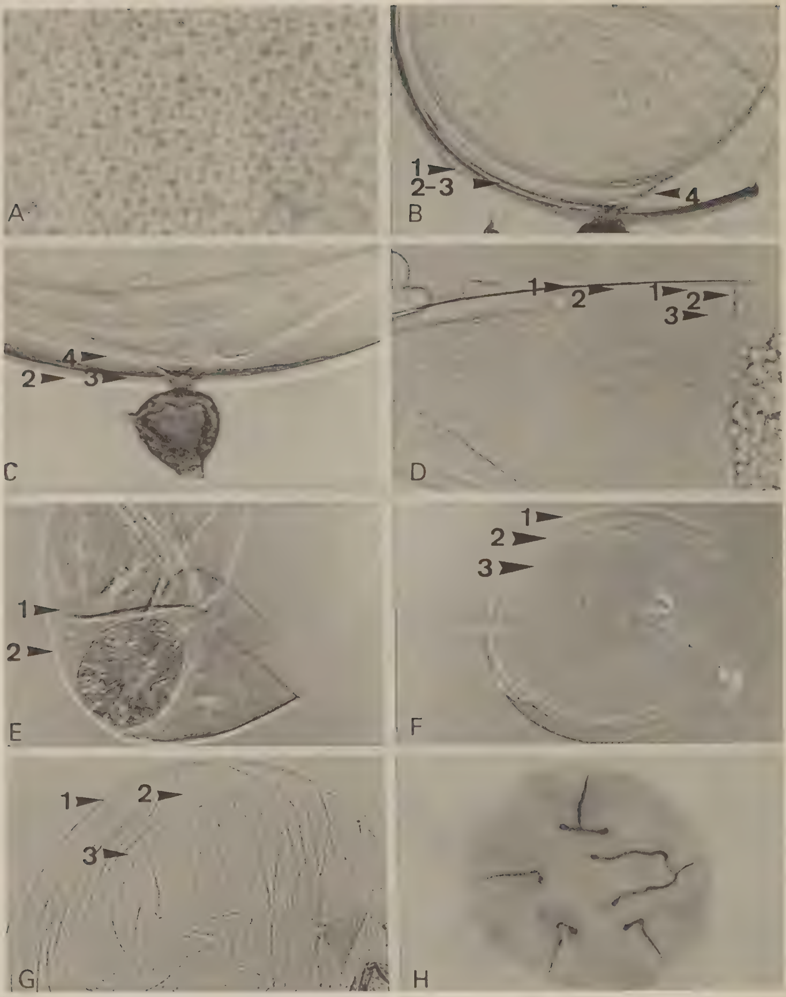


Figure 3. *Scutellospora cerradensis*. A. Spore Wall layer 1 papillose, water, 1000X. B. Spore Wall, layer one detached, PVLG, 200X. C. Spore wall, layer one missing, PVLG, 400X DIC. D. Inner Wall 1, two layers; Inner Wall 2, three layers; Spore Wall layer four visible above Inner Wall 1, PVLG 400X. E. Inner Wall 1, two layers, layer one wrinkled; both reactive to Melzer's reagent, 200X DIC. F. Inner Wall 2, three layers, layer 2 very plastic, PVLG, 200X DIC. G. Inner Wall 2, papillae on layer three rare. PVLG, 400X. H. Germination shield, PVLG 400X.

ETYMOLOGY: Place: cerrado; ensis. Epithet chosen to associate the species with the savannah ecosystem (cerrado) where it was found.

TYPE: From endomycorrhizal association with *Sorghum bicolor* L Moench in pot culture *Scutellospora* sp. CPAC-3 at CPAC/EMBRAPA, Planaltina, D.F. Brazil. Holotype: OSC; isotypes FH, K and IBt. Cultotype, isolate BR 103, deposited at INVAM (West Virginia University, Morgantown, WV).

DISCUSSION

Scutellospora cerradensis and *S. verrucosa* (Koske & Walker) Walker & Sanders have similar ornamentation, size and somewhat similar color when viewed in water against a white background by stereomicroscope, however, the shield is patent only in *S. cerradensis*. *Scutellospora verrucosa*, member of a sub-group including *S. coralloidea, S. fulgida, S. gregaria* and *S. persica* (Morton, 1995), lacks the second inner wall found in *S. cerradensis*. Mounted spores of *S. cerradensis* lacking ornamentation might also be confused with *S. gilmorei* (Trappe & Gerd.) Walker & Sanders, a smooth spore of similar size, color and wall number.

The spore wall of *S. cerradensis* has four phenotypically distinct layers. The outer layer is unique in its reaction to PVLG; unlike other described ornamented spores, the papillae are not structurally stable (3A). The ornamented layer reacts almost immediately and can appear as a fine reticulum or a roughened surface before detaching from the adjacent smooth layer (3B). Layer three was rarely perceived as laminate; the very thin and flexible innermost spore wall layer was not seen initially in water mounts. Although often appearing in PVLG mounted spores to be associated with the inner walls (3D), it clearly originates from the sporogenous cell (3B & 3C). It is not known whether there is discontinuity in the appearance of this layer as related to the other spore wall layers. This very thin flexible layer, not reported in the ontogenetic study of *S. heterogama* and *S. pellucida* (Franke & Morton, 1994), is present in both species and is not a species level character. Examination of a broader range of taxa in *Scutellospora* will help determine if it is a sub-genus or genus-level character.

The second inner wall is comprised of three layers (3D & 3F). This wall is a highly conserved primary character (Franke & Morton, 1994; Morton, 1995) and *Scutellospora* species described as having a bi-layered second inner wall are hypothesized to be equally complex. Papillae on the innermost layer of some spores (3G) are not considered a taxonomic character. Numerous spores of *S. gregaria*, an isolate native to the cerrado, develop papillae on the innermost layer prior to shield formation (Spain, unpub.). Papillae have also been observed on the innermost layer of an isolate of *S. verrucosa*, a spore with one flexible inner wall. It is not known whether this novelty is genetically induced or a response to biotic or abiotic factors.

Different mountants affect morphology and histochemical reactions of structures in spores of arbuscular fungi (Morton, 1990, Spain, 1990) The subcellular characters were detected and interpretable only with detailed comparisons in both water and PVLG. It is suggested that the example of Berch & Koske (1986) and Walker et al. (1993) be followed: diagnoses should be made from observations of spores mounted in water and PVLG. Although ontogenetic studies were not carried out with *S. cerradensis*, most of the developmental stages described by Franke & Morton (1994) were observed. If found in other habitats *S. cerradensis* should be readily identifiable.

ACKNOWLEDGEMENTS

We wish to thank Valter Lopes, long time assistant of Dr. Miranda at CPAC/EMBRAPA. We are grateful to Dr. Chris Walker for valuable suggestions and Dr. Joseph Morton for the critical review of the manuscript. Father Hugh Feiss OSB kindly provided the Latin translation and Dr. Stephen Alderman assisted with DIC photography. The senior author acknowledges the cooperation kindly given at CPAC/EMBRAPA in Brazil and the lab of Dr. Gabor Bethlenfelvay in Corvallis. Dr. James M. Spain was a valued critic.

LITERATURE CITED

Berch, S.M. and R.E.Koske. 1986. *Glomus pansihalos*: a new species in the Endogonaceae, Zygomycetes. Mycol. 78:838-842.

Franke, M. and J. Morton, 1994. Ontogenetic comparisons of arbuscular mycorrhizal fungi *Scutellospora heterogama* and *Scutellospora pellucida*: revision of taxonomic character concepts, species descriptions, and phylogenetic hypotheses. Can. J. Bot. 72:122-134.

Gerdemann, J.W. & J.M. Trappe. 1974. The Endogonaceae in the Pacific Northwest. Mycologia Memoir No. 5:1-76.

Morton, J.B. 1995. Taxonomic and phylogenetic divergence among five *Scutellospora* species based on comparative developmental sequences. Mycol. 87(1):127-137.

Morton, J.B. 1987. Effects of mountants and fixatives on wall structure and Melzer's reaction in spores of two *Acaulospora* species (Endogonaceae). Mycologia 78:787-794.

Spain, J.L. 1990. Arguments for diagnoses based on unaltered wall structures. Mycotaxon 38:71-76.

Walker, C., V. Gianinazzi-Pearson, and H. Marion-Espinasse, 1993. *Scutellospora castanea*, a newly described arbuscular mycorrhizal fungus. Cryptog. Mycol. 14:279-286.

MYCOTAXON

Volume LX, pp. 137-142 October-December 1996

GLOMUS BRASILIANUM: AN ORNAMENTED SPECIES IN THE GLOMACEAE

JOYCE LANCE SPAIN

3899 NW Jameson Dr. Corvallis, OR 97330

JEANNE CLAESSEN DE MIRANDA

EMBRAPA/CPAC Caixa Postal 08223
Planaltina, D.F. Brazil 73301-970

ABSTRACT

Glomus brasilianum, a hyaline, vesicular-arbuscular species with labyrinthiform ornamentation on an inner layer, was recovered from a dark red latosol in the experimental area of EMBRAPA/CPAC (Centro de Pesquisa Agropecuária dos Cerrados), Planaltina, D.F. Brazil. The description is based on a study of recently harvested spores mounted in water and in polyvinyl alcohol-lactic acid glycerol (PVLG), a mountant which induced morphological change.

RESUMO

Glomus brasilianum, uma espécie hialina, vesiculo-arbuscular com ornamentação labirintiforme em uma camada interna, foi coletada de um Latossolo Vermehlo Escuro na área experimental da EMBRAPA/CPAC (Centro de Pesquisa Agropecuária dos Cerrados), Planaltina, D.F. Brasil. A descrição é baseada em um estudo com esporos coletados recentemente e montados em água e em polivinil-álcool-ácido lático glicerol (PVLG), um montante indutor de modificações morfológicas.

INTRODUCTION

The native spore collection of vesicular-arbuscular mycorrhizae at the Cerrado Center includes several unidentified *Glomus* species in addition to *G. convolutum* Gerdemann & Trappe, *G. manihotis* Sieverding & Schenck and *G. occultum* Walker. *Glomus brasilianum*, initially found as a contaminant in a pot culture, was later recovered in field sampling. A detailed study revealed unique morphology.

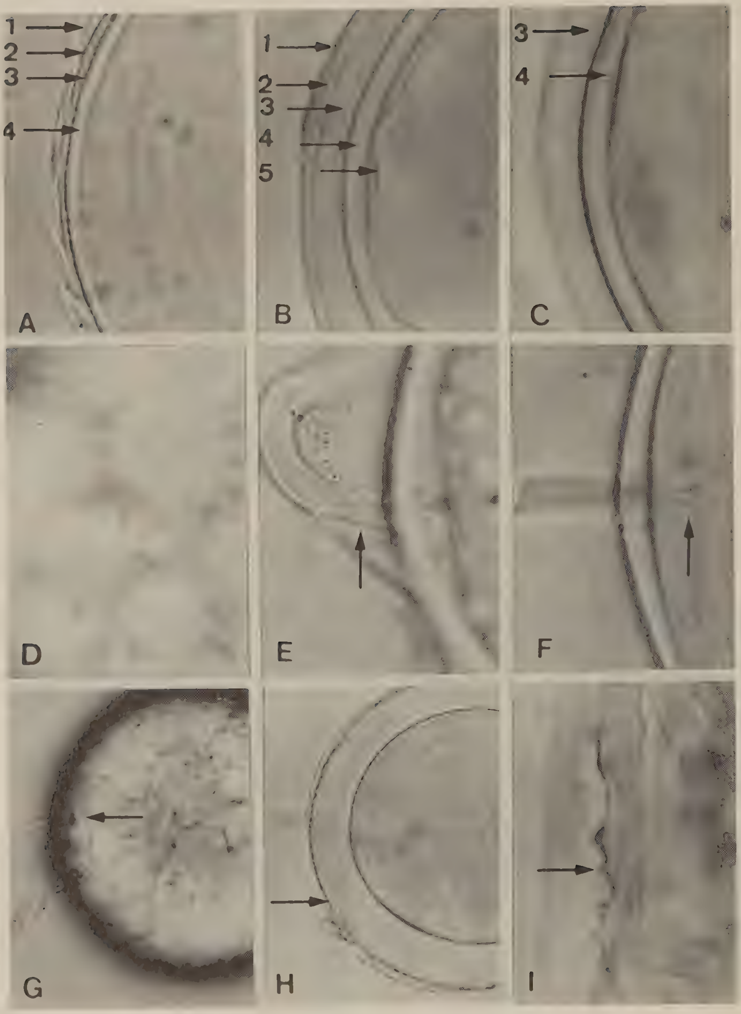


Figure 1. *Glomus brasilianum* A) Spore wall, water 1000X. B) Spore wall, PVLG 1000X. C) Spore wall, Melzer's reagent 1000X. D) Labyrinthiform ornamentation, layer 3, water 1000X. E) Sporophore ornamentation, water 1000X. F) Plug, water 1000X G) Germination through spore wall, water 400X. H) Halo effect; intact spore, PVLG 400X. I) Knobby intercellular hypha 1000X.

Spores isolated from a contaminated pot culture were inoculated into pots using *Allium porrum* as the host plant. A pure culture was obtained and spores, recovered by wet sieving with a fine mesh sieve (45µm), were examined by stereomicroscope against white and black backgrounds for color determination. The description is based on observations of intact and ruptured spores mounted in water, PVLG and Melzer's reagent examined at 1000X with a compound microscope. Type specimens were permanently mounted in PVLG; unmounted specimens were preserved in 5% formalin.

DESCRIPTION

Glomus brasilianum Spain et Miranda sp. nov. Figs. (1 & 2). Sporocarpia ignota. Sporae, hyalinae, communiter globosae (47.5-) 60-80 (-112.5) µm vel ellipsoideae (47.5-) 64 X 77 (-115) µm, singulae in solo feruntur in sporophoribus et raro in radiis senescentibus. Tunica sporae constituitur stratis quinque (ex mensuris sporarum ruptarum in aquis): primo, mucilagino, 0.5-<1.0 µm crasso, communiter cum detritu affixo et in secundo adherente; secundo, duro fragilique, 1 µm crasso; tertio, 1-2 µm crasso, forma labyrinthi ornato, adherente in quarto quod est lamellatum flexibileque, 1-3 µm crassum, adherens quinto, quod est membranaceum, 0.5-<1.0 µm crasso. Tubae germinativae tunicam penetrant.

Sporocarps unknown. Spores, hyaline, generally globose (47.5-) 60-80 (-112.5) µm or ellipsoid, (47.5-) 64 X 77 (-115) µm, borne singly on sporophore in soil and occasionally in senescent roots. Spore wall structure of five layers (measurements of ruptured spores in water). Spore wall layer 1, mucilagenous, 0.5-<1 µm thick usually with debris attached, generally adherent to layer 2, a brittle layer to 1µm thick; layer 3 with labyrinthiform ornamentation, 1-2 µm thick, adherent to layer 4, a flexible laminated layer 1-3 µm thick, greatest thickness near sporophore; layer 5, membranous, 0.5-<1 µm thick, usually appressed to layer 4, occasionally separating, more often discerned by wrinkling (Fig. 1B). The germ tube emerges through the spore wall.

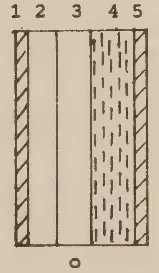


Figure 2. Murograph of spore wall structure, water mount.

REACTION TO COMMON MOUNTANT PVLG AND MELZER'S REAGENT: In PVLG, spore wall layer 1, mucilagenous, <1-1µm thick, often adheres, partially adheres or separates from layer 2, 1-2 µm thick. Layers 2 and 3 separate as layer 3, the ornamented layer, 1-2 µm thick initially, swells, losing definition. Layer 3 adheres to flexible laminated layer 4, 1-2.5 µm, laminae swelling and separating slightly at point of rupture; layer 5, membranous, 0.5 µm thick often separates from layer 4 (Fig. 1B). Over time a halo effect is created in many intact spores as the ornamented layer swells (Fig. 1-H). The dextrinoid reaction is absent in Melzer's reagent, however, the walls absorb pigment becoming yellow even in a dilute solution. The ornamented layer usually swells markedly, to 5 µm, creating striations (Fig. 1C).

GERMINATION: Germination tube emerges through the spore wall (Fig. 1G).

SPOROPHORE: Usually straight, sometimes curved, 5-6µm in diameter, generally coenocytic, often narrowing slightly near spore. Layers of sporophore wall are contiguous with the three outer layers, however, layers 1 and 2 are often missing in sieved spores and the ornamented layer is outermost (Fig. 1E).

MYCORRHIZAL ASSOCIATIONS: *Glomus brasilianum* is known to form mycorrhizae with *Allium porrum, Sorghum bicolor* L. Moench and *Stylosanthes guyanensis* var. vulgaris cv Minerão, host plant used for pot cultures. The infection is characterized by intracellular coiled hyphae and intercellular hyphae; projections are sometimes present on both (Fig. 1-I). Vesicles mounted in PVLG after staining with trypan blue are generally distinguished by a 2 µm thick wall; arbuscules have extremely fine ramifications and are observed as a very lightly stained mass when senescent.

DISTRIBUTION AND HABITAT: *Glomus brasilianum*, known first as a contaminant in the greenhouse (potting soil has a pH of 4.8 (2.5:1 HOH); Al 2.11 me/100g; Ca + Mg: 0.16 me/100g; P: 0.97 ppm; K: 12 ppm.) was also found in an experimental pasture planted to *Brachiaria decumbens* (dark red latosol with 4-5 ppm available P) at EMBRAPA/CPAC, Planaltina, D.F. Brazil (15° 35'33" south; 47° 42'30"; 1100 m altitude).

ETYMOLOGY: *brasilianum*, place Brazil, indicating that the species was first observed in Brazil.

TYPE: Spores recovered from pure pot culture *Glomus* sp. CPAC-5, an association of *G. brasilianum* with *A. porrum*. Type OSC; Isotypes: FH, K and IBt, INVAM Accession: BR105.

DISCUSSION

Morphological changes caused by mountants and preservatives were studied by Morton (1986, 1988) and noted by others (Berch & Fortin, 1983; Schenck et al., 1984; Berch & Koske, 1986). It has been suggested that descriptions of some spores be made from water mounts because altered walls do not represent spore morphology (Spain 1990). Spores of *G. brasilianum* are dramatically altered by both PVLG and Melzer's reagent. The ability to distinguish the detail of the ornamentation on spores mounted in PVLG or Melzer's reagent seems to be a function of time rather than spore age; the nature of the ornamentation generally is only apparent if observations are made in water or immediately following slide preparation when spores are mounted in PVLG.

Layers 1 and 2 are often entirely missing from sieved spores and the ornamented layer, contiguous with the sporophore (Fig. 1E), appears as the outer wall. The flexible laminated layer, first described by Koske and Gemma (1989), is rarely observed as laminate and perusal of numerous spores may be necessary to corroberate the finding. The layer is thicker near the sporophore (Fig. 1E & F) and usually has a slightly greater thickness at rupture sites. When appressed to layer 4, layer 5 is discerned because of wrinkling; the spore contents seem to be isolated by a plug (Fig. 1F).

Several observations were made of spores with a single germination tube emerging through the spore wall (Fig. 1G); occasionally the germination tube and the sporophore hypha anastomosed. Germinated spores with detached sporophore and germination tube, essentially empty of spore contents, also exhibited two openings in the spore wall. *Glomus albidum* (Walker and Rhodes, 1981) and *G. pallidum* (Hall, 1977) are also reported to germinate directly through the wall.

Different types of multiple walls (layers) account for most of the morphological diversity in the Glomaceae (Morton & Benny, 1990). *Glomus brasilianum* is an anomaly among described species having an ornamented inner structural layer. It is easily distinguished from *G. maculosum* Miller & Walker, a much larger spore with bulging discs not found in hyaline immature spores but present on the innermost membranous wall in many older straw-colored to ochraceous spores (suggesting a possible relationship to germination). Other hyaline spores are reported to have ornamentation on the outer layer: *G. callosum* Sieverding is ornamented with crowded minute warts; with age the mucilaginous coat of *G. clarum* Nicolson & Schenck becomes verrucose or rugose; *G. leptotichum* Schenck & Smith has an indistinct alveolate reticulum most apparent on young spores; *G. scintillans* Rose & Trappe is ornamented with hyaline knobs. The ornamentation of *G. brasilianum* resembles that of *Acaulospora rehmii* Sieverding and Toro (1987), however, it is unlikely that these species of different genera would ever be confused. Although the sporophore of *G. brasilianum* may detach, the very delicate labyrinthiform ornamentation on an inner structural layer distinguishes it from sessile spores of A. *rehmii* with similar, but much more prominent, ornamentation on the spore wall.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the support of CPAC/EMBRAPA. We are grateful for the assistance of Valter Lopes and José Moreis in the laboratory. We are indebted to Chris Walker for reviewing the manuscript and making helpful suggestions. Father Hugh Feiss OSB kindly provided the Latin diagnosis. The senior author wishes to thank James M. Spain for his encouragement and valuable criticism.

LITERATURE CITED

Berch, S.M. and J.A. Fortin, 1983. Lectotypification of *Glomus macrocarpum* and proposal of new combinations: *Glomus australe, Glomus versiforme*, and *Glomus tenebrosum* (Endogonaceae). Can. J. of Bot. 61:2608-2617.

Berch, S.M. and R.E. Koske, 1986. *Glomus pansihalos*, a new species in the Endogonaceae, Zygomycetes. Mycologia. 78:832-836.

Hall, I. 1977. Species and mycorrhizal infections of New Zealand Endogonaceae. Trans. Br. Mycol. Soc. 68:341-356.

Koske, R.E. and J.N. Gemma 1989. *Glomus nanolumen* (Endogonaceae), a new species from Hawaii. Mycologia 81:935-938.

Morton, J.B. 1986. Effects of mountants and fixatives on wall structure and Melzer's reaction in spores of two *Acaulospora* species (Endogonaceae). Mycologia 78:787-794.

Morton, J.B. 1988. Taxonomy of VA mycorrhizal fungi: classification, nomenclature, and identification. Mycotaxon 32:267-324.

Morton, J.B. and G.L. Benny 1990. Revised classification of arbuscular mycorrhizal fungi (Zygomycetes): A new order, Glomales, two new suborders, Glomineae and Gigasporineae, and two new families, Acaulosporaceae and Gigasporaceae, with an emendation of Glomaceae. Mycotaxon 37:471-491.

Schenck, N.C., J.L. Spain, E. Sieverding and R.H. Howeler, 1984. Several new and unreported vesicular-arbuscular mycorrhizal fungi (Endogonaceae) from Colombia. Mycologia 76:685- 699.

Sieverding, E. and S. Toro T. 1987. *Acaulospora denticulata* sp. nov. and *Acaulospora rehmii* sp. nov. (Endogonaceae) with ornamented spore walls. Angewandte Botanik 61:217-223.

Spain, J.L. 1990. Arguments for diagnoses based on unaltered wall structures. Mycotaxon 38:71-76.

Walker, C. and L.H. Rhodes 1981. *Glomus albidus*: A new species in the Endogonaceae. Mycotaxon: 12: 509-514.

MYCOTAXON

Volume LX, pp. 143-148 October-December 1996

ROYOPORUS - A NEW GENUS FOR FAVOLUS SPATHULATUS

A. B. DE

Department of Botany, Burdwan Raj College, Burdwan-713 104, W.B.,India

SUMMARY

Detailed observations on morphological and anatomical characters of Favolus spathulatus (Jungh.) Lev. are given based on fresh basidiocarps from India. In the light of these observations the new genus Royoporus De is proposed with Favolus spathulatus (Jungh.) Lev. as its type species.

During a mycological excursion fresh basidiocarps of a shortly stipitate poroid fungus of the Aphyllophorales (Polyporaceae) were collected by the author from a branch of a dead angiosperm at Amarkantak, Madhya Pradesh, India on October 20, 1993. After investigations this fungus was identified as Favolus spathulatus (Jungh.) Lev. The present paper reports the results of detailed studies on the morphological and anatomical characters of F. spathulatus. The taxonomy of this species is also discussed in the light of these findings. The combination of features which characterizes this fungus is not found in any other genus and, therefore, a new generic name is proposed :

Royoporus De, nov. gen.

Carpophorus stipitatis, pileus spathulatus vel flabellatus, stipus lateralis, contextus albus, hymenio albido vel ochraceo, poris hexagonis, radialiter instructus. Systema hypharum dimiticum. Hyphae generativae hyalinae, non-fibulatae. Basidia hyalina, clavata, 4-sterigmatibus, 18.4-22.0 x 3.0-6.0 µm, basidiosporae 5.0-8.0 x 2.0-3.0 µm, cylindricae, levis, hyalinae, tenuitunicatae, non-amyloideae.

SPECIES TYPICAE : Laschia spathulata Jungh.,Fl.Crypt.Java,75-76,1838.

ETYMOLOGIA : Secandum nomen Dr. Anjali Roy.

Basidiocarp stipitate, pileus spathulate to flabelliform, stipe lateral, context white, up to 1 mm thick, hymenium white to ochraceous, pores hexagonal, radially aligned. Hypal system dimitic with hyaline, simple septate generative hyphae and hyaline binding hyphae, Basidia hyaline, clavate, 4-sterigmate, 18.4-22.0x3.0-6.0 µm Basidiospores 5.0-8.0 x 2.0-3.0 µm, cylindrical, smooth, hyaline, thin-walled, non-amyloid.

1

2

Royoporus spathulatus (Jungh.) De, Comb. nov.

= Laschia spathulata Jungh., Fl. Crypt. Java, 75-76, 1838 (basionym) ; Favolus spathulatus (Jungh.) Lev., Ann. Sci. nat. Ser III, bot., Paris, 2 : 203, 1844 ; Favolus moluccensis Mont., Ann. Sci. nat. Ser. II. bot., Paris, 20 : 365, 1843 ; Polyporus moluccensis (Mont.) Ryv., Mycotaxon, 38 : 84, 1990.

Basidiocarp annual, solitary or several growing from a common point on the substratum, coriaceous and corky, very shortly stipitate ; pileus spathulate, flabelliform or dimidiate, tapering towards the base, upper surface (Fig.1) flat or slightly convex, may be depressed near the stipe, straw coloured with sharp fine radial striations ; margin thin, entire or lobed, sterile below ; hymenial surface (Fig.2) white to ochraceous, pores hexogonal, radially aligned, 1-4 per mm, dissepiments very thin, tubes up to 3 mm long ; context white, up to 1 mm thick. Stipe very short, lateral, about 5 mm in diameter and up to 8 mm long.
Hyphal system dimitic. Generative hyphae (Fig.3) hyaline, thin-walled, rarely slightly thick-walled, simple septate, branching not common, 1.5-3.5 µm wide, abundant in trama and rare in context. Binding hyphae (Fig.4) hyaline, corrugated, thick-walled, in the context showing wide lumina, in trama frequently subsolid to solid, usually dichotomously branched, 3.0-8.2 µm wide, often tapering to 1.5-2.0 µm. Gloeoplerous hyphae (Fig.5) present, up to 8 µm wide. Basidia (Fig.6) hyaline, clavate, 4-sterigmate, 18.4-22.0 x 3.0-6.0 µm. Basidiospores (Fig.7) hyaline, thin-walled, smooth, cylindrical, non-amyloid, 5.0-8.0 x 2.0-3.0 µm, some with one or two guttulae. Cystidioles (Fig.8) 18.0-24.0 x 3.0-6.0 µm.

TYPE OF ROT : White rot.

SPECIMEN EXAMINED : BRCMH P-1993, Madhya Pradesh, India, on dead branch of an unknown angiosperm, 20.10.1993. Kept in the Mycological Herbarium, Department of Botany, Burdwan Raj College, Burdwan West Bengal, India (BRCMH). The duplicate material (HCIO 41026) has been deposited in the Herbarium of the Division of Mycology and Plant Pathology, Indian Agricultural Research Institute, New Delhi, India.

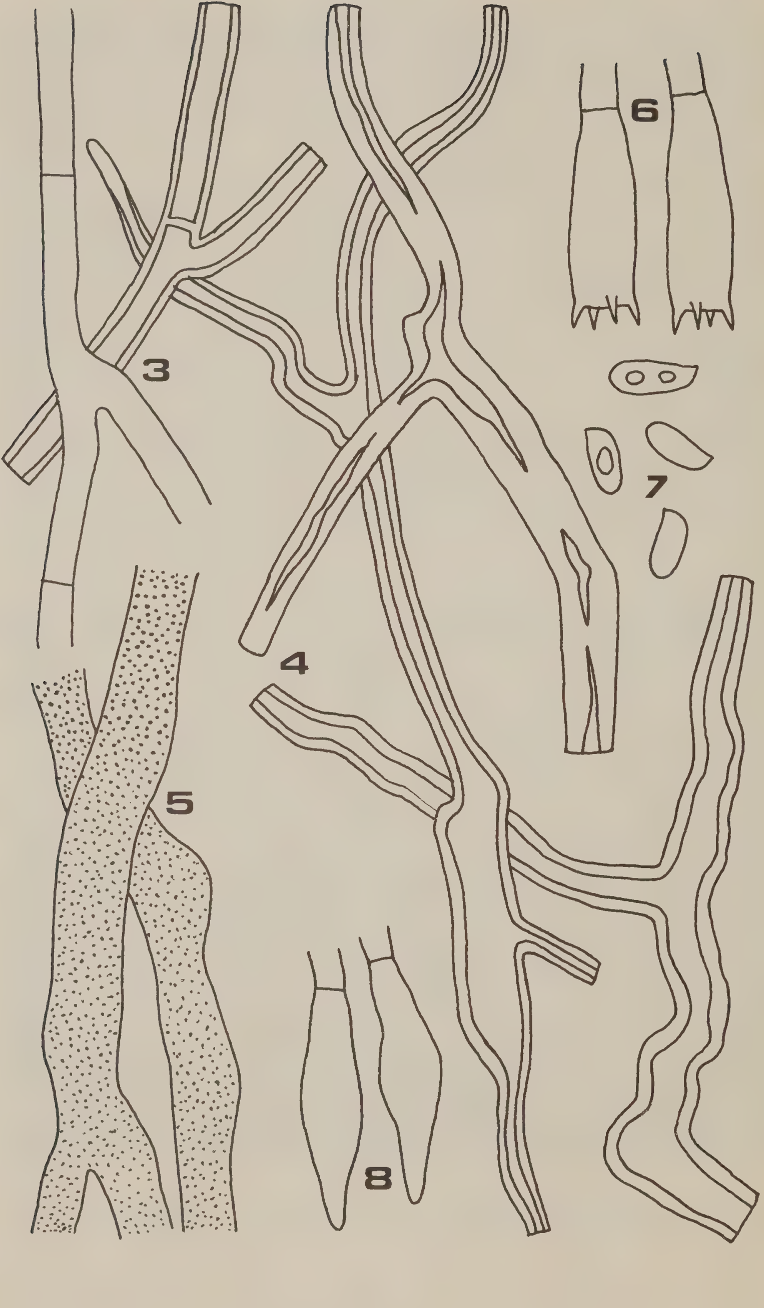
ETYMOLOGY : The generic epithet after the celebrated mycologist of India Dr. Anjali Roy (Department of Botany, Visva-Bharati University, Santiniketan, West Bengal, India).

DISCUSSION

The genus Favolus Fr. (Elench. Fung., P.44, 1828) was previously regarded as distinct from the genus Polyporus Fr. (Syst. Myc. 1 : 341, 1821) due to lack of clamps in the former and their presence in the latter (Ryvarden and Johansen 1980). But Stankovicova (1973) in a detailed study of the hyphal system of Favolus brasiliensis (Fr.) Fr. [=Favolus tenuiculus Beauv.], the type species of the genus Favolus Fr., described clamps. Gilbertson and Ryvarden (1987) and Ryvarden (1990) agreed, and they corrected the error in Ryvarden and Johansen

---

Figs.1 & 2. Royoporus spathulatus (Jungh.) De : 1.upper surface of basidiocarp ; 2. hymenial surface of basidiocarp.


3
4
5
6
7
8

(1980) which stated the hyphae were simple septate. Due to presence of clamps in the type species of both of these genera, *Favolus* could not be kept as a separate genus and Corner (1984) proposed to merge *Favolus* Fr. with *Polyporus* s. str. This view was supported by Ryvarden (1990) and Teixeira (1994). Gilbertson and Ryvarden (1987), Roy De and Pal (1994) and Teixeira (1994) have accepted the transfer of *Favolus tenuiculus* Beauv. (= *F. brasiliensis*), the type species of the genus *Favolus* Fr., to the genus *Polyporus* Fr. made by Fries (1821). But *Favolus spathulatus* (Jungh.) Lev. having simple septate generative hyphae (Ryvarden and Johansen 1980) could not be transferred to *Polyporus* along with *F. tenuiculus* and generic position of *F. spathulatus* became uncertain. In 1990 Ryvarden transferred *F. spathulatus* to the genus *Polyporus* Fr. and he made a new combination *Polyporus moluccensis* (Ryvarden 1990) although he did not explain whether clamps were observced by him in this species. Mention may be made in this connection that Junghuhn's name *Laschia spathulata* of 1838 is the oldest name for this taxon but when it was transferred to the genus *Polyporus*, Ryvarden (1990) could not coin the name *Polyporus spathulatus* as this name was preoccupied by another polypore [*Polyporus spathulatus* (Hook.) Fr. Epior. Mycol. 1838]. Montagne described this species in 1843 as *Favolus moluccensis* Mont. [Ann. Sci. nat. Ser. II, bot., Paris, 20 : 365, 1843] and his name was therefore used by Ryvardon (1990). Thus *Polyporus moluccensis* is the name for the fungus (*F. spathulatus*) in the genus *Polyporus*.

But my study based on fresh basidiocarps revealed that *F. spathulatus* has simple septate generative hyphae. Thus its inclusion in *Polyporus* Fr., a genus characterized by the presence of clamps in all species, can not be agreed upon. Moreover, *F. spathulatus* exhibits a combination of characters that can not be found in any other existing genus : (a) spathulate to flabelliform basidiocarp with very short, lateral stipe, (b) poroid hymenial surface with radially aligned hexagonal pores, (c) white context, (d) dimitic hyphal system with hyaline, simple septate generative hyphae and hyaline binding hyphae, (e) hyaline, thin-walled, smooth, cylindrical, non-amyloid basidiospores, and (f) an association with a white rot of angiospermic wood.

I, therefore, propose a new genus *Royoporus* De to accommodate *F. spathulatus* and the transfer *F. spathulatus* as : *Royoporus spathulatus* (Jungh.) De, comb. nov. (Basionym : *Laschia spathulata* Jungh., Fl. Crypt. Java, 75-76, 1838).

ACKNOWLEDGEMENTS

The author is indebted to Dr. Leif Ryvarden, University of Oslo, Norway for confirming the identification of the fungus and for his valuable comments. The author is also indebted to Dr. J. Ginns, Curator, National Mycological Herbarium of Canada, for critically reviewing the manuscript.

Figs. 3-8. Microscopic structures from basidiocarp of *Royoporus spathulatus* (Jungh.) De : 3. generative hyphae ; 4. binding hyphae ; 5. gloeoplerous hyphae ; 6. basidia ; 7. basidiospores ; 8. cystidioles.

REFERENCES

Corner, E.J.H. 1984. Ad Polyporaceas II & III. Beiheft. Nova Hedwigia, 78 : 1-222.

Fries, E.M. 1821. Systema mycologicum, Vol. I. Lundae, P. Lvii + 520.

Gilbertson, R. L. and L. Ryvarden, 1987. North American polypores, Vol. 2, Fungiflora, Oslo, Norway.

Roy, Anjali, A.B. De and S. Pal. 1994. The genus Polyporus, s. str. Fr. in India. Crypt. Bot. 4 : 381-393.

Ryvarden, L. 1990. Type studies in the Polyporaceae 22. Species described by C. G. Lloyd in Polyporus. Mycotaxon, 38 : 83-102.

Ryvarden, L. and Johansen, 1980. A preliminary polypore flora of East Africa. Fungiflora, Oslo, Norway.

Stankovicova, L. 1973. Hyphal structure in some pleurotoid species of Agaricales. Nova Hedwigia, 24 : 61-120.

Teixeira, A. R. 1994. Genera of Polyporaceae : an objective approach. Boletim da chacara Botanica de Itu. 1 : 1-91.

MYCOTAXON

Volume LX, pp. 149-174 October-December 1996

CHYTRIDIOMYCETE TAXONOMY SINCE 1960

Joyce E. Longcore

Department of Plant Biology and Pathology
University of Maine
Orono, Maine 04469-5722 U.S.A.

ABSTRACT: More than 300 species and 23 genera of Chytridiomycetes have been described since F.K. Sparrow's 1960 edition of *Aquatic Phycomycetes*, which contained monographic coverage of the class. Furthermore, recent authors have presented many new combinations and suggestions for synonymy. This bibliography is organized alphabetically by taxon and lists all new taxa and taxonomic changes that have been published since 1960. Entries for new species include information about substrates and habitats.

KEY WORDS: Blastocladiales, Chytridiales, Chytridiomycetes, Monoblepharidales, Neocallimastigales, Spizellomycetales, taxonomy

INTRODUCTION: Thirty-five years ago F.K. Sparrow (1960) published a monograph that covered the Chytridiomycetes and other aquatic, zoosporic fungi. This comprehensive work brought together all taxonomic literature on chytrids (excluding the genera *Synchytrium* and *Physoderma*) since the first report by Braun in 1856. Further contributions to chytrid systematics include a key to genera (Sparrow 1973), and keys to some genera and species in a book on aquatic mycology (Batko 1975). Karling's (1977) *Chytridiomycetarum Iconographia* represents a significant contribution. He discussed the genera of Chytridiomycetes and presented many useful drawings, but did not include a comprehensive list of species. More recently, Barr (1990) reviewed current ideas of the phylogeny of the Chytridiomycetes, but no monograph has superseded that of Sparrow. New species continue to be described and taxonomic changes continue to be published, but articles are dispersed in many journals and searches to locate all described species in a genus are time consuming. The *Index of Fungi* contains entries for most new species and taxonomic changes. All classes of fungi are included in the *Index* and it is arranged by date, thus, a search for all species in a particular genus requires an issue by issue search of several volumes. [Volumes 1-4 of the *Index* are now available electronically from the United States National Fungus Collections and can be searched by genus or species for 1940-1980. (TELNET FUNGI.ARS-GRIN.GOV; at "OK," type: **login user**; at "Password?" type: **user**)] The following bibliography, which includes new taxa, new combinations, and suggested synonymies, differs substantially from the *Index of Fungi* because the list brings together, alphabetically by genus, all chytridiomycete taxonomic references for 1960-1995. Without the ability to easily search for all described species in a genus, identifications are difficult and earlier homonyms are not detected. For example, *Rhizophydium spinosum* has been used as a name for a new species by three authors since Sparrow (1960).

This compilation is only a listing and inclusion herein does not reflect my opinion of the status of a species or change in classification. Spelling of names is that given in the *Index of Fungi* where, in some instances, orthographic corrections were made. New species in certain parasitic genera are not included, namely: *Coelomomyces* and *Physoderma* (Blastocladiales) and *Synchytrium* (Chytridiales). Because *Harpochytrium* was not included in Sparrow's monograph, I have included species described before 1960. Citations contain inclusive pagination for articles instead of only the page containing the description or the taxonomic change. This variance from convention is to facilitate the retrieval of entire articles via interlibrary photocopy services. Names of new taxa at the genus level and above are printed entirely in upper case letters. Except where noted, I have examined photocopies or reprints of all cited articles. Figures, substrates, and habitats are listed only for new species. This list is maintained as a database file and will be updated. Please send additions and corrections to the author.

ABBREVIATIONS AND DEFINITIONS: Blastocladiales, [**B**]; British Columbia, **B.C.**; Chytridiales, [**C**] ;California, **CA**; *Chytridiomycetarum Iconographia* (Karling 1977), **CI;** county, **Co**.; English Lake District, **E.L.D.**; Florida, **FL**; *Handbook of Protoctista* (Barr 1990), **HP**; Hawaii, **HI**; *Index of Fungi*, **IF;** Indiana, **IN**; Louisiana, **LA**; Monoblepharidales, [**M**]; Massachusetts, **MA**; Maryland, **MD**; Michigan, **MI**; mountain, **Mt**.; Neocallimastigales, [**N**]; North Carolina, **NC**; New Zealand, **N.Z.**; ***nomen nudum*** signifies that a taxon has no diagnosis [S.N. Dasgupta (1982) published a "Discourse on aquatic phycomycetes of India." In appendix VI of this paper he presented a list of aquatic fungi from studies at Lucknow. Among these are species listed as new for which I have been unable to find descriptions. These are included herein with the designation "? *nomen nudum*."]; Spizellomycetales, [**S**]; South America, **S.A**.; southeast, **SE**; United Kingdom, **U.K**.; United States of America, **USA**; University, **U**.; Uttar Pradesh, **U.P.**; Virginia, **VA**; *Zarys Hydromikologii* (Batko 1975), **ZH**; = indicates an opinion that taxa are taxonomic synonyms; ≡ indicates nomenclatural synonymy.

ACKNOWLEDGMENTS: I thank the staff of the Interlibrary Loan Department, University of Maine Library, especially Libby Soifer and Barbara Jones, for their cooperation in obtaining copies of journal articles; Donna Pond, Department of Plant Biology and Pathology, University of Maine for help with printing; and Donald J.S. Barr, Centre for Land and Biological Resources Research, Agriculture Canada for constructive suggestions and for supplying an early copy of a paper in press. This work was encouraged and funded by Jerry R. Longcore and aided by a donation of reprints from R.E. Reichle. I thank D.J.S. Barr and Amy Y. Rossman for helpful reviews of the manuscript.

REFERENCES

Barr, D.J.S. 1990. Phylum Chytridiomycota. Pp. 454-466. *In*: *Handbook of Protoctista*, Eds. L. Margulis, J.O. Corliss, M. Melkonian, and D.J. Chapman. Jones & Bartlett Publishers, Boston, Massachusetts.

Batko, A. 1975. *Zarys Hydromikologii*. Państwowe Wydawnictwo Naukowe, Warsaw, Poland.

Dasgupta, S.N. 1982. Discourse on aquatic phycomycetes of India. Indian Phytopathol. **35**: 193-216.

Index of fungi. 1960-1995 (Vols. 3-6). C.A.B. International, Wallingford, United Kingdom.

Karling, J.S. 1977. *Chytridiomycetarum Iconographia*. Lubrecht & Cramer, Monticello, New York.

Sparrow, F.K. 1960. *Aquatic Phycomycetes*, 2nd rev. ed. University of Michigan Press, Ann Arbor, Michigan.

Sparrow, F.K. 1973. Chytridiomycetes, Hyphochytridiomycetes. Pp. 85-110. *In*: *The Fungi. IVB*, Eds. G.C. Ainsworth, F.K. Sparrow, and A.S. Sussman. Academic Press, New York.

ALLOCHYTRIDIUM Salkin [C]; Amer. J. Bot., **57**: 649-658. 1970
= *Karlingia*; Karling; Nova Hedwigia, **28**: 209-229. 1976; but *Allochytridium* recognized by Barr & Désaulniers; see Mycologia, **78**: 439-448. 1986

Allochytridium expandens Salkin; Amer. J. Bot., **57**: 649-658, figs. 2-49. 1970
≡ *Karlingia expandens* (Salkin) Karling; Nova Hedwigia, **28**: 209-229. 1976
Saprophytic; onion skin; roadside puddle, Solano Co., CA

Allochytridium luteum D.J.S. Barr & Désaulniers; Mycologia, **79**: 193-199, figs. 1-26. 1987
Saprophytic; boiled grass; beach sand close to water level, Ontario, Canada

Allomyces; Karling (Mycopath. Mycol. Appl., **49**: 169-122. 1973) established subgenera.
For review of genus see L. Olson; Opera Bot. **73**: 1-96. 1984

Allomyces attomyces in S.N. Dasgupta; Indian Phytopathol. **35**: 215. 1982 ? *nomen nudum*

Allomyces catenoides Sparrow; Mycologia, **56**: 460-461. 1964 (Latin description)
For figs. see Sparrow & Morrison; Pap. Michigan Acad. Sci., **46**: 175-181, 2 Pls. 1961
Saprophytic; hemp seed; aquarium with tropical fish

Allomyces reticulatus Emerson & Robertson; Amer. J. Bot., **61**: 303-317, figs. 14-21. 1974
Contains **key** to genera of Blastocladiaceae
Saprophytic; house fly bait; cracked dry soil from drainage ditch; CA, USA

Amphicypellus Ingold 1944 = *Chytriomyces* Karling 1945; Dogma, I.J., Jr., Philipp. J. Biol. **5**: 121-142 (p. 136) 1976. Dogma lists *Chytriomyces* as *nomen conservandum*, however, *Chytriomyces* is not listed as a conserved genus in the Tokyo Code.

Amphicypellus elegans Ingold 1944 ≡ *Chytriomyces elegans* (Ingold) I.J. Dogma; Philipp. J. Biol. **5**: 121-142 (p. 136). 1976

ANAEROMYCES Breton et al. [N]; FEMS Microbiol. Lett., **70**: 177-182. 1990
= *Ruminomyces* Y.W. Ho 1990; described later, see: Mycotaxon, **47**: 283-284. 1993

Anaeromyces elegans (Y.W. Ho) Y.W. Ho; Mycotaxon, **47**: 283-284. 1993
≡ *Ruminomyces elegans* Y.W. Ho 1990

Anaeromyces mucronatus Breton et al.; FEMS Microbiol. Lett. **70**: 177-182, fig. 1 a-f. 1990
Lectotype: see Y.W. Ho & D.J.S. Barr; Mycologia 87: 656-678. 1995
Saprophytic; hay; rumen of holstein cows; France

ARNAUDOVIA Valkanov [C]; Arch. Protistenk., **106**: 553-564. 1963 (no Latin diagnosis)
= *Polyphagus*; Karling; **CI**, p. 174. 1977

Arnaudovia hyponeustonica Valkanov (no Latin diagnosis); Arch. Protistenk., **106**: 553-564, Pls. 40-43. 1963; ≡ *Polyphagus hyponeustonica* (Valkanov) Karling 1977
Parasitic; *Phacotus, Trachelomonas, Strombomonas spp.*; ditch; Longoza, Bulgaria

Asterophlyctis irregularis Karling; Sydowia, **20**: 96-108, figs. 1-16. 1967
≡ *Septosperma irregulare* (Karling) I.J. Dogma 1974
Saprophytic; Chitin bait; water containing Characeae; Lake Ohau, N.Z.

Asterophlyctis sarcoptoides H.E. Petersen 1903 ≡ *Diplophlyctis sarcoptoides* (H.E. Petersen) I.J. Dogma; Nova Hedwigia, **25**: 121-141. 1974

Blastocladia arborata S.N. Dasgupta & R. John; Indian Phytopathol., **41**: 521-547, figs. 1-3. 1988. Saprophytic; styles of submerged flowers of *Caryopteris*; tanks; Lucknow U., India

Blastocladia caduca S.N. Dasgupta & R. John; Indian Phytopathol., **41**: 521-547, figs. 36-38. 1988. Saprophytic; styles of submerged flowers of *Cretavea*; tanks; Lucknow U., India

Blastocladia coronata S.N. Dasgupta & R. John; Indian Phytopathol., **41**: 521-547, figs. 39-43. 1988. Saprophytic; fruit of *Eugenia jambolana* bait; tanks; Lucknow U., India

Blastocladia cristata in S.N. Dasgupta; Indian Phytopathol. **35**: 215. 1982; ? *nomen nudum*

Blastocladia didyma S.N. Dasgupta & R. John; Indian Phytopathol., **41**: 521-547, fig. 29. 1988
Saprophytic; fruit of *Physalis peruviana* bait; tanks; Lucknow U., India

Blastocladia elegans S.N. Dasgupta & R. John; Indian Phytopathol., **41**: 521-547, figs. 21-22. 1988. Saprophytic; mango fruit bait; tanks; Lucknow U., Lucknow

Blastocladia excelsa S.N. Dasgupta & R. John; Indian Phytopathol., **41**: 521-547, figs. 33-35. 1988. Saprophytic; ripe guava fruit bait; tanks; Lucknow U., India

Blastocladia filamentosa S.N. Dasgupta & R. John; Indian Phytopathol., **41**: 521-547, figs. 27, 28. 1988. Saprophytic; *Eugenia jambolana* fruit bait; tanks; Lucknow U., India
Blastocladia fruticosa S.N. Dasgupta & R. John; Indian Phytopathol., **41**: 521-547, figs. 4, 5. 1988. Saprophytic; *Eugenia jambolana* fruit bait; tanks; Lucknow U., India
Blastocladia fusiformis S.N. Dasgupta & R. John; Indian Phytopathol., **41**: 521-547, figs. 30-32. 1988. Saprophytic; stamens and pistils of *Crataeva religiosa*; tanks; Lucknow U., India
Blastocladia globosa var. ***minutissima*** C. Manoharachary et al.; Bibl. Mycol., **91**: 457-462, fig. 1 D. 1983. Saprophytic; unripe mango fruit bait; temple pond; Vikarabad, A.P., India
Blastocladia heterosporangia S.N. Dasgupta & R. John; Indian Phytopathol., **41**: 521-547, figs. 44-45. 1988. Saprophytic; submerged grape as bait; River Gomti; Lucknow, India
Blastocladia mammilata S.N. Dasgupta & R. John; Indian Phytopathol., **41**: 521-547, figs. 15-17. 1988. Saprophytic; submerged *Pyrus* fruit bait; tanks; Lucknow U., India
Blastocladia picaria in S.N. Dasgupta; Indian Phytopathol. **35**: 215. 1982 ? *nomen nudum*
Blastocladia pileota S.N. Dasgupta & R. John; Indian Phytopathol., **41**: 521-547, figs. 9-11. 1988. Saprophytic; submerged *Pyrus* fruit bait; tanks; garden, Lucknow U., India
Blastocladia pusilla S.N. Dasgupta & R. John; Indian Phytopathol., **41**: 521-547, figs. 6-8. 1988 Saprophytic; mango fruit bait; tanks; Lucknow U., India
Blastocladia sessilis S.N. Dasgupta & R. John; Indian Phytopathol., **41**: 521-547, figs. 23-24. 1988. Saprophytic; jamun and guava bait; tanks; Lucknow U., India
Blastocladia spiciformis S.N. Dasgupta & R. John (**IF** 5:946); Indian Phytopathol., **41**: 521-547, figs. 12-14. 1988. Saprophytic; guava bait; tanks; Lucknow U., India
Blastocladiella; Karling established subgenera *Blastocladiella, Eucladiella & Cystocladiella*; Mycopath. Mycol. App. **49**: 169-172. 1973
Blastocladiella anabaenae Canter & Willoughby; Journ. Roy. Micr. Soc., Ser. 3, **83**: 365-372, Pls. 159-162. 1964. Parasitic; *Anabaena flos-aquae & A. circinalis*; Lake Windermere plankton; E.L.D., U.K.
Blastocladiella britannica Horenstein and Cantino; Trans. Brit. Mycol. Soc., **44**: 185-198, Pl. 15. 1961. For figs. see Willoughby; Trans. Brit. Mycol. Soc., **42**: 287-291. 1959 Saprophytic; grass, snake skin, hemp seed; periodically inundated soil; E.L.D., U.K.
Blastocladiella colombiensis Karling; Nova Hedwigia, **40**: 329-340, Pls. II & III, figs. 4-34, 1984. Saprophytic; snake skin, insects, rarely hempseed; dry soil; La Guajira, Colombia
Blastocladiella nova-zeylandiae Karling; Sydowia, **20**: 144-150, figs. 4-29. 1967 Saprophytic; bleached corn leaves and snake skin; soil; N.Z.
Blastocladiopsis elegans Robertson; Canad. J. Bot., **54**: 611-615, figs. 1-7. 1976; = *Ramocladia reticulata* Sorgel 1952 (*nomen nudum*). Saprophytic; fly; soil; Virginia Beach, VA, USA
Blyttiomyces aureus Booth; Syesis, **2**: 141-161, figs. 15-22, 58-61. 1969
= *B. laevis* 1952; T.W. Johnson; Norw. J. Bot. **24**: 83-88. 1977
Saprophytic; pine pollen; occasionally saline soil; Saturna Island, B.C., Canada
Blyttiomyces conicus T.W. Johnson; Norw. J. Bot., **24**: 83-88, figs. 1-24. 1977
Saprophytic; pine pollen; water & *Sphagnum*; stream, Lysekloster, Norway
Blyttiomyces exuviae in S.N. Dasgupta; Indian Phytopathol., **35**: 215. 1982 ? *nomen nudum*
Blyttiomyces gregarum in S.N. Dasgupta; Indian Phytopathol., **35**: 215. 1982 ? *nomen nudum*
Blyttiomyces harderi Sparrow & I.J. Dogma; Arch. Mikrobiol., **89**: 177-204, fig. 3, A-I. 1973
Parasitic; *Rhizophlyctis rosea*; soil; Santo Domingo, Dominican Republic
Blyttiomyces laevis Sparrow 1952 = *Blyttiomyces aureus* Booth 1969; T.W. Johnson; Norw. J. Bot., **24**: 83-88. 1977
Blyttiomyces lenis S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 42. 1988
Parasitic; zygospore of *Spirogyra*; ditch; Sultanpur Road, SE of Lucknow U., India
Blyttiomyces rhizophlyctidis I.J. Dogma; Mycologia, **61**: 1149-1158, figs. 1-21. 1969
Parasitic; *Rhizophlyctis rosea*; soil sample; Petersburg, VA, USA
Blyttiomyces spinosus S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, figs. 38-41. 1988. Saprophytic ?; *Spirogyra*; aquatic habitat; Lucknow, India

Blyttiomyces vaucheriae (Rieth) I.J. Dogma; Mycologia, **61**: 1149-1158. 1969
≡ *Phlyctochytrium vaucheriae* Rieth 1956

CAECOMYCES Gold [**N**] in Gold et al.; BioSystems, **21**: 403-415. 1988

Caecomyces communis Gold et al.; BioSystems, **21**: 403-415. 1988
= *Sphaeromonas communis* sensu Orpin; J. Gen. Microbiol., **94**: 270-280. 1976

Caecomyces equi Gold; BioSystems, **21**: 403-415. figs. 1-20. 1988; ? = *C. communis 1988*; see Y.W. Ho & D.J.S. Barr; Mycologia **87**: 656-678. 1995
Saprophytic; plant material; caecum of horse

Callimastix cyclopis Weissenberg belongs in the Blastocladiales; see Vavra & Joyon Protistologica, **2**: 5-15 and Pls. I-VI. 1966; also Manier & Lubès, Protistologica, **4**: 493-501. 1978 (not seen)

Callimastix frontalis Braune (described as protozoan; no Latin diagnosis); Arch. Protistenk., **32**: 111-170, figs. 13-15. 1914 = *Neocallimastix frontalis* Vavra & Joyon ex Heath 1983

CANTERIA Karling [**C**]; Arch. Mikrobiol., **76**: 126-131. 1971
based on *Phlyctidium apophysatum* Canter 1947

Canteria apophysata (Canter) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Phlyctidium apophysatum* Canter 1947

Catenaria auxiliaris (Kühn) Tribe; Trans. Brit. Mycol. Soc., **69**: 367-376. 1977
Parasitic; *Heterodera* (nematodes); soil; England

Catenaria indica Singh & Pavgi; Mycologia, **62**: 587-590, figs. 1-6. 1970
Saprophytic; keratin bait; soil; Varanasi, U.P., India

Catenaria ramosa W. Martin; Mycologia, **70**: 461-467, figs. 3-6. 1978
Parasitic; midge eggs (*Dicrotendipes modestus*); streams; VA, USA

Catenaria spinosa W. Martin; Mycologia, **67**: 264-272, figs. 1-15. 1975
Parasitic; chironomid eggs; small stream; VA, USA

Catenaria uncinata W. Martin; Mycologia, **70**: 461-467, figs. 1,2,7,8. 1978
Parasitic; midge eggs (*Glyptotendipes lobiferus*); lakes and ponds; VA, USA

Catenaria vermicola Birchfield; Mycopathol. Mycol. Appl. **13**: 331-338, figs. 1-3. 1960
Parasitic; plant parasitic nematodes (*Xiphinema chambersi*); soil; Shreveport, LA, USA

Catenaria verrucosa Karling; Sydowia, **20**: 144-150, figs. 1-2. 1967
Saprophytic; snake skin bait; soil sample; N.Z.

Catenochytridium hemicysti Knox; in D.J.S. Barr et al.; Mycologia, **79**: 587-594, figs. 1-25. 1987. ≡ *Chytridium hemicysta* Knox; PhD dissertation, 1970; VPI, VA; not validly published
Saprophytic; cellophane, algae, pollen; Riopel's Pond; Mt. Lake Biological Station, VA, USA

Catenochytridium marinum (Kobayasi & Ookubo) Karling; **CI**, p. 166. 1977
≡ *C. carolineanum f. marinum* Kobayasi & Ookubo 1953

Catenochytridium oahuense Sparrow (**IF 3**:323); Mycopathol. Mycol. Appl., **25**: 119-143, figs. 67-70, 1965. Saprophytic; cellophane bait; soil; Oahu, HI, USA

CATENOPHLYCTIS Karling [**B**]; Amer. J. Bot., **52**: 133-138. 1965

Catenophlyctis peltata (Sparrow) Karling; Nova Hedwigia, **15**: 191-201. 1968 ≡ *Phlyctorhiza peltata* Sparrow 1950

Catenophlyctis variabilis (Karling) Karling; Amer. J. Bot., **52**: 133-138. 1965 ≡ *Phlyctorhiza variabilis* Karling 1947; ≡ *Entophlyctis variabilis* (Karling) Cejp 1959; Omagiu lui Traian Savulescu, 129-138. 1959

Catenophlyctis variabilis var. ***olduvaiensis*** Karling; Nova Hedwigia, **27**: 747-771, figs. 48-63. 1976. Saprophytic; snake skin and corn leaves; soil; Olduvai Gorge, Tanzania

CAULOCHYTRIACEAE Subramanium; Curr. Sci., **43**: 722-723. 1974. Emended by L. Olive; Amer. J. Bot., **67**: 568-574. 1980. Placed in Spizellomycetales by D.J.S. Barr; **HP**, p. 463. 1990

CAULOCHYTRIUM Voos & Olive [**S**]; Mycologia, **60**: 730-733. 1968

Caulochytrium gloeosporii Voos & Olive; Mycologia, **60**: 730-733, figs. 1-5. 1968; also see Voos; Amer. J. Bot., **56**: 898-909. 1969 .
Parasitic; *Gloeosporium* sp. on dead leguminous pods; near Miami, FL, USA

Caulochytrium protostelioides Olive; Amer. J. Bot., **67**: 568-574, figs. 1-24. 1980
Parasitic; *Cladosporium* sp. on dead flowers; St. Vincent, British West Indies
Chytridiales emended by D.J.S. Barr; Canad. J. Bot., **58**: 2380-2394. 1980
Chytridium Braun (in part) = *Diplochytridium* Karling 1971. Karling emends genus (Arch. Mikrobiol., **76**: 126-131. 1971). F.K. Sparrow (Taxon, **22**: 583-586. 1973) presents figs. and documents location of type for *C. olla* Braun.
Chytridium adpressum S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 55. 1988
Saprophytic ?; vegetative cell of *Spirogyra*; ditch; Sultanpur Road, SE of Lucknow U., India
Chytridium aggregatum Karling 1938 ≡ *Diplochytridium aggregatum* (Karling) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium apophysatum in S.N. Dasgupta; Indian Phytopathol, **35**: 215. 1982; ? *nomen nudum*
Chytridium brevipes Braun 1856 ≡ *Diplochytridium brevipes* (Braun) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium cejpii Fott 1950 ≡ *Diplochytridium cejpii* (Fott) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium chlorobotryis Fott (**IF 3**:38) 1952 ≡ *Diplochytridium chlorobotryis* (Fott) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium citriforme Sparrow 1952 ≡ *Diplochytridium citriforme* (Sparrow) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium closterii S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 66. 1988
Saprophytic ?; *Closterium*; tank; Lucknow U., India
Chytridium codicola Zeller 1918 ≡ *Diplochytridium codicola* (Zeller) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium coleochaetes Nowakowski 1876 not *Rhizophydium coleochaetes* (Nowak.) Fischer Canter; Trans. Brit. Mycol. Soc., **43**: 14-18. 1960
Chytridium confervae (Wille) Minden ≡ *Chytriomyces confervae* (Wille) A. Batko; **ZH**, p. 210. 1975
Chytridium corniculatum Kobayasi & Konno; Bull. Natl. Sci. Mus., **14**: 1-18, fig. 6. 1971
Saprophytic; pine pollen; sand in fresh water; Angmagssalik, Greenland
Chytridium cresentum in S.N. Dasgupta; Indian Phytopathol., **35**: 215. 1982; ? *nomen nudum*
Chytridium deltanum Masters; Canad. J. Bot., **49**: 471-481, figs. 2-4. 1971
Parasitic; *Oocystis* spp.; phytoplankton; Lake Manitoba, Canada
Chytridium fusiforme S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 57. 1988
Saprophytic; vegetative cell of *Spirogyra*; ditch; Sultanpur Road, SE of Lucknow U., India
Chytridium gibbosum Scherffel 1902 ≡ *Diplochytridium gibbosum* (Scherffel) Karling; Arch. Mikrobiol., **76**: 126-131. 1971; Johnson (Nova Hedwigia, **23**: 187-199. 1972) placed into synonymy with *Chytridium schenkii* (Dangeard) Scherffel 1886.
Chytridium horariumforme S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 51. 1988. Parasitic; oospore of *Spirogyra*; ditch; Sultanpur Road, SE of Lucknow U., India
Chytridium hyperparasiticum Kobayasi & Konno; Bull. Natl. Sci. Mus., **14**: 1-18, fig. 2 B. 1971
Parasitic; sporangium of *Rhizophlyctis rosea*; soil in water; Angmagssalik, Greenland
Chytridium inflatum Sparrow 1933 ≡ *Diplochytridium inflatum* (Sparrow) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium isthmiophilum Canter; Trans. Brit. Mycol. Soc., **43**: 660-664, fig. 1. 1960
≡ *Diplochytridium isthmiophilum* (Canter) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Parasitic; *Staurodesmus curvatus* (desmid); plankton, lakes; E.L.D., U.K.
Chytridium kolianum Domján 1936 ≡ *Diplochytridium kolianum* (Domján) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium lagenaria Schenk 1858 (in part) ≡ *Diplochytridium lagenarium* (Schenk) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium latipodium in S.N. Dasgupta; Indian Phytopathol., **35**: 215. 1982; ? *nomen nudum*

Chytridium mallomonadis Fott; Preslia, **29**: 278-319, fig. 11: 1-4. 1957
≡ *Diplochytridium mallomonadis* (Fott) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Parasitic; *Mallomonadis tonsuratae* resting spores; pond; Prague, central Bohemia
Chytridium marylandicum Paterson; Mycologia, **54**: 694-703, figs. 1-7, 17 & 18. 1962
Saprophytic; matrix of *Botryococcus*; Blue Pond; Muirkirk, MD, USA
Chytridium mucronatum Sparrow & M. Barr 1955; ≡ *Diplochytridium mucronatum* (Sparrow & M. Barr) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium neopapillatum Kobayasi & Konno; Bull. Natl. Sci. Mus., **14**: 1-18, fig. 7 A. 1971
Saprophytic; pine pollen; sand in water; Angmagssalik, Greenland
Chytridium oedogonii Couch 1938 ≡ *Diplochytridium oedogonii* (Couch) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium ottariense Roane (**IF 4**:241); Mycologia, **65**: 531-538, figs. 3-14. 1973
Saprophytic; *Volvox*, chitin, snake skin; impoundment; Pulaski County, VA, USA
Chytridium parasiticum Willoughby 1956; ≡ *Chytriomyces willoughbyi* (Willoughby) Karling; Mycopath. Mycol. Appl., **36**: 165-178. 1968
Chytridium pilosum Kobayasi & Konno; J. Jap. Bot., **45**: 325-337, fig. 2 A-K. 1970
Saprophytic; cellophane bait; soil from evergreen forest; Tsushima Island, Japan
Chytridium proliferum Karling; Sydowia, **20**: 119-128, figs. 16-28. 1967
Saprophytic; pollen, corn leaves, snake skin; acidic soil; N.Z.
Chytridium reniforme S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 54. 1988
Saprophytic ?; *Spirogyra*; ditch; Sultanpur Road, SE of Lucknow U., India
Chytridium schenkii (Dangeard) Scherffel 1886 emended by T.W. Johnson; Nova Hedwigia, **23**: 187-199. 1972 = *Chytridium gibbosum* Scherffel 1902
≡ *Diplochytridium schenkii* (Dangeard) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium schenkii var. ***dumontii*** I.J. Dogma; Philipp. Agric., **57**: 49-54, figs. 1-21. 1973
Saprophytic; cellophane, lens paper, onion skin; moist soil; Columbia, S.A.
Chytridium scherffelii (Scherffel) Sparrow 1936
≡ *Diplochytridium scherffelii* (Sparrow) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium sexuale Koch 1951 ≡ *Diplochytridium sexuale* (Koch) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium sparrowii S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 56. 1988
Saprophytic ?; *Spirogyra*; ditch; Sultanpur Road, SE of Lucknow U., India
Chytridium stellatum (Petersen) Koch 1951 ≡ *Diplochytridium stellatum* (Petersen) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytridium telmatoskenae Fott; Preslia, **29**: 278-319, fig. 11: 5-10. 1957
Parasitic; *Telmatoskene mucosa*; pond; Volary, central Bohemia
Chytridium turbinatum Kobayasi & Ookubo 1954 ≡ *Diplochytridium turbinatum* (Kobayasi & Ookubo) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
Chytriomyces Karling 1945 includes *Amphicypellus* Ingold 1944; I.J. Dogma: Philipp. J. Biol. **5**: 121-142 (p. 136). 1976. Dogma lists *Chytriomyces* as *"nomen conservandum"*; however *Chytriomyces* is not on the conserved list in the Tokyo Code.
Chytriomyces angularis Longcore; Mycologia, **84**: 442-451, figs. 1-28. 1992
Saprophytic; pollen, snake skin; lakes, *Sphagnum*; Maine, USA
Chytriomyces annulatus I.J. Dogma; Nova Hedwigia, **18**: 349-365, figs. 1-18. 1969
Saprophytic; pollen, snake skin; leaf litter and forest soils; USA
Chytriomyces confervae (Wille) A. Batko; **ZH**, p. 210. 1975 ≡ *Chytridium confervae* (Wille) Minden 1915
Chytriomyces cosmarii Karling; Sydowia, **20**: 119-128, figs. 1-7. 1967
Parasitic; *Cosmarium* spp.; soil, hillside sheep paddock; Taita, N.Z.
Chytriomyces elegans (Ingold) I.J. Dogma; Philipp. J. Biol. **5**: 121-142 (p. 136). 1976
≡ *Amphicypellus elegans* Ingold 1944
Chytriomyces gilgaiensis Willoughby; Arch. Mikrobiol., **52**: 101-131, fig. 6 a-l. 1965
Parasitic; *Nowakowskiella crassa*; soil, gilgai depression; Victoria, Australia

Chytriomyces heliozoicola Canter; Trans. Brit. Mycol. Soc., **49**: 633-638, fig. 1. 1966
Parasitic; *Raphidiocystis lemani;* plankton of lakes; E.L.D., U.K.

Chytriomyces hyalinus Karling emended by Bostick; J. Elisha Mitchell Sci. Soc. **84**: 94-99. 1968

Chytriomyces hyalinus var. ***granulatus*** Karling; Sydowia, **20**: 119-128, figs. 8-15. 1967
Saprophytic; corn leaves, chitin, and snake skin; soil; widespread in N.Z.

Chytriomyces laevis Karling; Nova Hedwigia, **44**: 137-139, figs. 1-18. 1987
Parasitic; *Pythium*; soil, stream bank; Panama

Chytriomyces macro-operculatus Karling; Nova Hedwigia, **34**: 645-668, figs. 24-38, 1981
Saprophytic; cellophane & corn cotyledons; sandy organic soil; Isla Orquidia, Venezuela

Chytriomyces macro-operculatus var. ***hirsutus*** Karling; Nova Hedwigia, **34**: 645-668. figs. 39-45. 1981. Saprophytic; cellophane; sandy organic soil; Isla Orquidia, Venezuela

Chytriomyces mammilifer Persiel; Arch. Mikrobiol., **36**: 283-305, figs. 9, 10. 1960
Saprophytic; pine pollen; soil from altitude of 4 K; Ecuador

Chytriomyces mortierellae Persiel; Arch. Mikrobiol., **36**: 283-305, figs. 6, 7. 1960
Parasitic; *Mortierella*; soil sample; summit of Piz Buin, Austria

Chytriomyces multi-operculatus Sparrow & I.J. Dogma; Arch. Mikrobiol., **89**: 177-204, fig. 5. 1973. Saprophytic; pine pollen; shallow, black soil; Dominican Republic

Chytriomyces nagatoroensis Konno; Sci. Rep. Tokyo Kyoiku Daigaku Sect. B, **14**: 227-292, Pl. 4, fig. X. 1972. Parasitic-weak; *Spirogyra* sp.; water?; Nagatoro (Saitama Prefecture), Japan

Chytriomyces poculatus Willoughby & Townley; Trans. Brit. Mycol. Soc., **44**: 177-184, fig. 3, Pl. 14. 1961. Saprophytic; snake skin; soil; E.L.D., U.K.

Chytriomyces reticulatus Persiel; Arch. Microbiol., **36**: 283-305, fig. 8. 1960
Parasitic; *Pythium proliferum*; soil from flower pot; Gottingen, Germany

Chytriomyces reticulosporus I.J. Dogma; Philipp. J. Biol., **12**: 385-408, figs. 10-21. 1983
Parasitic; *Phlyctochytrium punctatum*; cultivated soils; Luzon, Philippines

Chytriomyces rhizidiomycetis I.J. Dogma (**IF** 5:282); Philipp. J. Biol., **12**: 385-408, figs. 1-9. 1983. Parasitic; *Rhizidiomyces bivellatus*; cultivated soils; Philippines & Japan

Chytriomyces rotoruaensis Karling; Arch. Microbiol., **70**: 266-287, figs. 1 P-Y, 2 A-S. 1970
Saprophytic; purified shrimp chitin; mud, cooled thermal pool; Rotorua, N.Z.

Chytriomyces suburceolatus (Willoughby) Willoughby; Nova Hedwigia, **7**: 133-150. 1964
≡ *Chytridium suburceolatum* Willoughby 1956

Chytriomyces vallesiacus Persiel; Arch. Mikrobiol., **36**: 283-305, fig. 11. 1960
Saprophytic; pine pollen; soil; "Felsband am Rimpfischhorn im Wallis," Austria

Chytriomyces verrucosus Karling; Bull. Torrey Bot. Club, **87**: 326-336, figs. 19A-K. 1960
Parasitic; *Karlingia rosea*; soil; Lafayette, IN, USA

Chytriomyces willoughbyi (Willoughby) Karling; Mycopathol. Mycol. Appl., **36**: 165-178. 1968
≡ *Chytridium parasiticum* Willoughby 1956

Cladochytrium aureum Karling 1949 = *C. replicatum* Karling 1931; Karling; Sydowia, **20**: 129-136. 1967

Cladochytrium granulatum (Karling) Sparrow 1960 ≡ *Nowakowskiella granulata* Karling; Sydowia, Beiheft VI, p. 66. 1966

Cladochytrium indicum Singh & Pavgi; Hydrobiologia, **37**: 565-568, figs. 1-7. 1971
Saprophytic; snake skin bait; soil; Deoria, U.P., India

Cladochytrium novoguineense Kobayasi & Konno; Bull. Natl. Sci. Mus., **14**: 373-386, fig. 3 C-I. 1971. Saprophytic; cellophane and onion skin; soil; Papua, New Guinea & Solomon Islands

Cladochytrium replicatum Karling 1931 = *C. aureum* Karling 1949; Karling; Sydowia, **20**: 129-136. 1967

Cladochytrium salsuginosum A. Batko & S.K.M. Hassan; Acta Mycol., **22**: 189-192, figs. 1-9. 1986 (1988); Saprophytic; onion skin bait; brackish water; near Frombork, northern Poland

Coelomomycetaceae; new spp.not included, see "The genus *Coelomomyces*", Eds. J.N. Couch & C.E. Bland, Academic Press, Inc., New York. 1985

Coelomycidium; placed in Blastocladiales; D.J.S. Barr **HP**, p. 463. 1990

Cylindrochytrium endobioticum Willoughby; Nova Hedwigia, **7**: 133-150, Pls. 17, 18 a-d, 23. 1964. Saprophytic; cellophane and grass leaf baits; soil; Bogle Crag Wood, Lancashire, U.K.
Cystocladiella Karling (subgenus of *Blastocladiella*); Mycopath. Mycol. Appl. **49**: 169-172. 1973
Dangeardia appendiculata (Zopf) Batko; Acta Mycol., **6**: 407-435. 1970 (contains **key** to *Dangeardia*) ≡ *Scherffeliomyces appendiculatus* (Zopf) Sparrow 1936
Dangeardia echinulata A. Batko; Acta Mycol., **6**: 407-435, figs. 6-20. 1970
Parasitic; *Vitreochlamys (Sphaerellopsis) aulata*; pool near Vistula River; Warsaw, Poland
Dangeardia molesta (Canter) A. Batko; **ZH**, p. 179. 1975 ≡ *Entophlyctis molesta* Canter 1965
Dangeardia ovata Paterson; Mycologia, **50**: 453-468, figs. 1-6. 1958
Parasitic; *Sphaerocystis schroeteri*; plankton, lakes; Washtenaw Co., MI, USA
Dangeardia sporapiculata Geitler; Sydowia, **16**: 324-330, figs. 1-2. 1963
Parasitic; *Chlamydomonas* palmaloid stage; lake; near Lunz, Austria
Dangeardia sporapiculata var. ***minor*** Geitler (? no type); Oesterr. Bot. Z., **112**: 603-609. 1965
Parasitic; *Heleochloridis pallidae*; soil; Schladming, Austria
DANGEARDIANA Valkanov ex A. Batko [C]; Acta Mycol., **6**: 407-435, 1970; includes **key** to related forms. = *Dangeardiana* Valkanov (no Latin diagnosis); Arch. Mikrobiol., **48**: 239-246. 1964. Karling doubted need to separate from *Dangeardia* (**CI,** p. 100. 1977).
Dangeardiana apiculata (Braun) A. Batko; Acta Mycol., **6**: 407-435. 1970
≡ *Entophlyctis apiculata* (Braun) Fischer (1892); also see Karling: **CI** p. 100. 1977
Dangeardiana eudorinae Valkanov ex A. Batko; Acta Mycol., **6**: 407-435. 1970
≡ *Dangeardiana eudorinae* Valkanov (no Latin diagnosis); Arch. Mikrobiol., **48**: 239-246, figs. 1-12. 1964. Parasitic; oospores of *Eudorina elegans*; water; Sofia, Bulgaria
Dangeardiana leptorrhiza (Johns) A. Batko; Acta Mycol., **6**: 407-435. 1970
≡ *Scherffeliomyces leptorrhizus* Johns 1956
Dangeardiana sporapiculata (Geitler) A. Batko; Acta Mycol., **6**: 407-435. 1970
≡ *Dangeardia sporapiculata* Geitler 1963
DICTYOMORPHA Mullins [C]; Amer. J. Bot., **48**: 377-387. 1961 ≡ *Pringsheimiella* Couch 1939 (invalid homonym)
Dictyomorpha dioica Couch ex Mullins; Amer. J. Bot., **48**: 377-387, figs. 1-37. 1961
≡ *Pringsheimiella dioica* Couch 1939. Parasitic; Oomycetes; Mirror Lake; Highlands, NC, USA
Dictyomorpha dioica var. ***pythiensis*** N. Sarkar & R. Dayal; Proc. Natl. Acad. Sci. India, Sect. B, **58**: 403-406, figs. 1-10. 1988
Parasitic; *Pythium aphanidermatum*; Kurukshetra Pond; Varanasi, U.P., India
DIPLOCHYTRIDIUM Karling [C]; Arch. Mikrobiol., **76**: 126-131. 1971
Segregate of *Chytridium* Braun
Diplochytridium aggregatum (Karling) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium aggregatum* Karling 1938
Diplochytridium brevipes (Braun) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium brevipes* Braun 1856
Diplochytridium cejpii (Fott) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium cejpii* Fott 1950
Diplochytridium chlorobotryis (Fott) Karling (**IF 3**:62); Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium chlorobotytris* Fott 1952
Diplochytridium citriforme (Sparrow) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium citriforme* Sparrow 1952
Diplochytridium codicola (Zeller) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium codicola* Zeller 1918
Diplochytridium gibbosum (Scherffel) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium gibbosum* Scherffel 1926
Diplochytridium inflatum (Sparrow) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium inflatum* Sparrow 1933
Diplochytridium isthmiophilum (Canter) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium isthmiophilum* Canter 1960

Diplochytridium kolianum (Domján) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium kolianum* Domján 1936
Diplochytridium lagenarium var. ***japonense*** (Kobayasi & Ookubo) Karling; Arch. Mikrobiol., **76**: 126-131. 1971; ≡ *Chytridium lagenaria* var. *japonense* Kobayasi & Ookubo 1953
Diplochytridium lagenarium (Schenk) Karling (**IF 4**:62); Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium lagenaria* Schenk 1858 (pro parte)
Diplochytridium mallomonadis (Fott) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium mallomonadis* Fott 1957
Diplochytridium mucronatum (Sparrow & M. Barr) Karling; Arch. Mikrobiol., **76**: 126-131. 1971; ≡ *Chytridium mucronatum* Sparrow and M. Barr 1955
Diplochytridium oedogonii (Couch) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium oedogonii* Couch 1938
Diplochytridium schenkii (Scherffel) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium schenkii* Scherffel 1926
Diplochytridium scherffelii (Sparrow) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium scherffelii* Sparrow 1936
Diplochytridium sexuale (Koch) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium sexuale* Koch 1951
Diplochytridium stellatum (Petersen) Karling; Arch. Mikrobiol., **76**: 126-131. 1971
≡ *Chytridium stellatum* (Petersen) Koch 1951
Diplochytridium? turbinatum (Kobayasi & Ookubo) Karling; Arch. Mikrobiol., **76**: 126-131. 1971; ≡ *Chytridium turbinatum* Kobayasi & Ookubo 1954
Diplophlyctis asteroidea I.J. Dogma & **key** to chitinophilic *Diplophlyctis* spp.; Trans. Brit. Mycol. Soc., **67**: 255-264, figs.1-3. 1976; Saprophytic; chitin; acid bogs; northern MI, USA
Diplophlyctis buttermerensis (Willoughby) Dogma (**IF 3**:420); Arch. Mikrobiol., **66**: 203-219, 1969; ≡ *Nephrochytrium buttermerense* Willoughby 1962
A. Batko retains *N. buttermerense*; **ZH**, p. 220. 1975
Diplophlyctis chitinophila Willoughby; Trans. Brit. Mycol. Soc., **45**: 121-136, fig. 5. 1962
Saprophytic; chitin; submerged mud; lakes, E.L.D., U.K.
Diplophlyctis complicata (Willoughby) Dogma (**IF 3**:306); Nova Hedwigia, **25**: 143-159. 1974
≡ *Nephrochytrium complicatum* Willoughby 1961
Diplophlyctis nephrochytrioides Karling; Sydowia, **20**: 109-118, figs. 36-67. 1967
Saprophytic?; *Nitella*, moribund internodes; Lake Ohau; Canterbury Province, N.Z.
Diplophlyctis sarcoptoides (Petersen) I.J. Dogma; Nova Hedwigia, **25**: 121-141. 1974
≡ *Asterophlyctis sarcoptoides* Petersen 1903
Dogma (*loc.cit.*) designated figs. 1-38 on Pls. I-IV as neotype.
Diplophlyctis sexualis Haskins 1950 ≡ *Nephrochytrium sexuale* (Haskins) A Batko; **ZH**, p. 220. 1975
Diplophlyctis versiformis I.J. Dogma; Philipp. J. Biol., **5**: 121-142, figs. 1-25. 1976
Saprophytic; shrimp chitin; Bryant's Bog, Smith's Bog; MI, USA
Endochytrium cystarum I.J. Dogma; Arch. Mikrobiol., **66**: 203-219, figs. 26-39. 1969
Saprophytic; lens paper and cellophane bait; forest soil and leaf litter; MI, USA
Endochytrium multiguttulatum I.J. Dogma; Arch. Mikrobiol., **66**: 203-219, figs. 1-25. 1969
Saprophytic; lens paper, cellophane, onion; bogs; Cheboygan Co., MI, USA
Entophlyctis Fischer 1892; D.J.S. Barr (Canad. J. Bot., **58**: 2380-2394. 1980.) emended and placed in Spizellomycetales; Longcore et al. (Canad. J. Bot., **73**: 1385-1390. 1995) rejected emendment and described *Powellomyces* for *Entophlyctis* (*sensu* Barr, 1980);
Entophlyctis (*sensu* Fischer) is in Chytridiales, see Longcore; Mycologia, **87**: 25-33. 1995
Entophlyctis apiculata (Braun) Fischer 1892 ≡ *Dangeardiana apiculata* (Braun) A. Batko; Acta Mycol., **6**: 407-435. 1970
Entophlyctis bulligera (Zopf) Fischer (1884) = *Entophlyctis confervae-glomeratae* (Cienkowski) Sparrow (1857); D.J.S. Barr: Canad. J. Bot., **49**: 2215-2222. 1971

Entophlyctis bulligera var. ***brevis*** S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 44. 1988; Saprophytic ?; vegetative *Spirogyra*; ditch; Sultanpur Road, SE of Lucknow U., India

Entophlyctis caudiformis S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 47. 1988. Saprophytic ?; *Closterium*; tank; Lucknow U., India

Entophlyctis confervae-glomeratae (Cienkowski) Sparrow (1857); D.J.S. Barr (Canad. J. Bot., **49**: 2215-2222. 1971) considers the following synonyms: = *E. bulligera* (Zopf) Fischer; = *E. vaucheriae;* (Fisch) Fischer, = *E. helioformis* (Dangeard) Ramsbottom; = *E. rhizina* (Schenk) Minden. Powell & Koch (Canad. J. Bot., **55**: 1668-1685. 1977) do not consider *E. bulligera* a synonym.

Entophlyctis crenata Karling; Sydowia, **20**: 109-118, figs. 1-12. 1967 Saprophytic; *Vallisneria* sp.; small brook; Wellington Province, N.Z.

Entophlyctis filamentosa in S.N. Dasgupta; Indian Phytopathol. **35**: 215. 1982; ? *nomen nudum*

Entophlyctis helioformis (Dangeard Ramsbottom (1886); = *Entophlyctis confervae-glomeratae* (Cienkowski) Sparrow (1857); D.J.S. Barr: Canad. J. Bot., **49**: 2215-2222. 1971

Entophlyctis lobata Willoughby & Townley; Trans. Brit. Mycol. Soc., **44**: 177-184. figs. 1-2, Pl. 13. 1961. Saprophytic; shrimp chitin bait; littoral of Derwentwater; E.L.D., U.K.

Entophlyctis luteolus Longcore; Mycologia, **87**: 25-33, figs. 1-20. 1995 Saprophytic; onion skin and *Utricularia*; bogs and acid lake; Maine (also MI), USA

Entophlyctis mammilliformis S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 46. 1988. Saprophytic ?; oospores of *Spirogyra*; pond; Mohanlalganj, east of Lucknow U., India

Entophlyctis molesta Canter; J. Roy. Microscop. Soc. London, **84**: 549-557, figs. 1-4. 1965 ≡ *Dangeardia molesta* (Canter) A. Batko 1975 ?Parasitic; *Stylosphaeridium stipitatum*; phytoplankton; English lakes, U.K.

Entophlyctis obscura Sparrow & I.J. Dogma; Arch. Mikrobiol., **89**: 177-204, fig. 2 A-S. 1973 Saprophytic; pine pollen bait; soil; Dominican Republic

Entophlyctis reticulospora P. Cook; Trans. Brit. Mycol. Soc., **49**: 545-550, Pls. 28-29. 1966 Parasitic; *Closterium moniliferum* et al.; swampy area; Cheboygan Co., MI, USA

Entophlyctis rhizina (Schenk) Minden (1858) = *Entophlyctis confervae-glomeratae* (Cienkowski) Sparrow (1857); D.J.S. Barr; Canad. J. Bot., **49**: 2215-2222. 1971

Entophlyctis sphaerioides S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 48. 1988. Saprophytic ?; reproductive body of *Spirogyra*; ditch; Sultanpur Road, SE of Lucknow U., India

Entophlyctis texana Karling 1941; see Sydowia, **20**: 109-118. 1967 for 1st published figs.

Entophlyctis variabilis (Karling) Cejp; Omagiu lui Traian Savulescu, 129-138. 1959 ≡ *Phlyctorhiza variabilis* Karling 1947; ≡ *Catenophlyctis variabilis* (Karling) Karling 1965

Entophlyctis variabilis Powell & Koch [not *E. variabilis* (Karling) Cejp 1959] (homonym) ≡ *Powellomyces variabilis* Powell & Koch ex Longcore et al. 1995 Saprophytic; pollen and *Paspalum* leaf; soils; NC, USA

Entophlyctis vaucheriae (Fisch) Fischer 1884; = *Entophlyctis confervae-glomeratae* (Cienkowski) Sparrow 1857; D.J.S. Barr; Canad. J. Bot., **49**: 2215-2222. 1971

Entophlyctis willoughbyi Bradley (fossil); Amer. J. Bot., **54**: 577-582, figs. 1-7, 9. 1967 In fossil plant parts; Eocene Green River Formation, Wyoming, USA

Eucladiella Karling (subgenus of *Blastocladiella*); Mycopath. Mycol. App. **49**: 169-172. 1973

GAERTNERIOMYCES D.J.S. Barr [**S**]; Canad. J. Bot., **58**: 2380-2394. 1980

Gaertneriomyces semiglobiferus (Uebelmesser) D.J.S. Barr; Canad. J. Bot., **58**: 2380-2394. 1980 ≡ *Phlyctochytrium semiglobiferum* Uebelmesser 1956; = *P. californicum* D.J.S. Barr, 1969

Gaertneriomyces tenuis D.J.S. Barr; Canad. J. Bot., **62**: 1171-1201, figs. 129-137. 1984 Saprophytic; pollen; soil; near Port William Dyke, Nova Scotia, Canada

Gonopodya terrestris S.N. Dasgupta et al. (probably not a *Gonopodya*); Indian Phytopathol., **43**: 218-222, Figs. 1-8. 1990. Saprophytic; leaves of *Eugenia jambolana*; moist soil; garden, Lucknow U., India

Hapalopera Fott 1942; accepted by A. Batko; **ZH**, Pp. 169-170. 1975; rejected by Karling; **CI**, Pp. 64, 65. 1977

Hapalopera achnanthis (Friedmann) A. Batko; **ZH**, p. 170. 1975 ≡ *Rhizophydium achnanthis* Friedmann 1952

Hapalopera difficilis (Canter) A. Batko; **ZH**, p. 169. 1975 ≡ *Rhizophydium difficile* Canter 1954

Hapalopera fragilariae (Canter) A. Batko; **ZH**, p. 170. 1975 ≡ *Rhizophydium fragilariae* Canter 1950

Hapalopera melosirae (Friedmann) A. Batko; **ZH**, p. 170. 1975 ≡ *Rhizophydium melosirae* Friedmann 1952

Hapalopera piriformis Fott; A. Batko; **ZH**, p. 170. 1975 ≡ *Rhizophydium piriformis* (Fott) Karling; **CI**. p. 65. 1977

HARPOCHYTRIACEAE Wille; Petermann's Geog. Mitt. Ergänzungsband, **28**: 370-371. 1900
Emended by Emerson & Whisler; Arch. Mikrobiol., **61**: 195-211. 1968
Placed in Chytridiales by D.J.S. Barr; **HP**, p.463. 1990

HARPOCHYTRIALES Emerson & Whisler; Arch. Mikrobiol., **61**: 195-211. 1968
Not used by D.J.S. Barr; **HP**, p.463. 1990; used by Powell & Roychoudhury; Canad. J. Bot., **70**: 750-761. 1992

HARPOCHYTRIUM Lagerheim; Hedwigia, **29**: 142-145. 1890
Placed in Harpochytriales by Emerson & Whisler; Arch. Mikrobiol., **61**: 195-211. 1968
From Harpochytriales to Chytridiales; Barr; **HP**, p.463. 1990

Harpochytrium adpressum Scherffel; Arch. Protistenk., **54**: 510-528, Pl. 28, figs.17, 18. 1926
Saprophytic; *Spirogyra jugalis*; water near igloo

Harpochytrium apiculatum Pascher (paper not seen) see: Pascher; Heterokonten, Lief. 5 in Rabenhorst's Kryptogamen-Flora von Deutschland II. Leipzig. 1938

Harpochytrium botryococci Jane; J. Linn. Soc., Bot., **53**: 28-40, figs. 14-18. 1946
Saprophytic; in mucilage of *Botryococcus*; water; Llyn Bychan, Caernarvonshire, U.K.

Harpochytrium hedenii Wille; Petermann's Geogr. Mitt. Ergänzungsband **28**: 370-371. 1900
Saprophytic; *Zygnema, Oedogonium, Spirogyra*;

Harpochytrium hyalothecae Lagerheim; Hedwigia, **29**: 142-145, figs. 1-4. 1890
On *Hyalotheca dissiliens*; "Lassby backar"; Upsala, Sweden

Harpochytrium intermedium Atkinson; Ann. Mycol., **1**: 479-502, Pl. 10, fig. 22, 23. 1903
Saprophytic; Confervae; marsh; near Ithaca, New York, USA
F.W. Jane considers this species a *nomen nudum*; J. Linn. Soc., Bot., **53**: 28-40. 1946

Harpochytrium monae Jane; J. Linn. Soc., Bot., **53**: 28-40, figs. 19-22. 1946
Saprophytic; *Zygnema*; temporary pool; Llandegfan Common, Anglesey, U.K.

Harpochytrium natrophilum Hortobágyi (alga); Bot. Közlem., **48**: 217-223. 1960

Harpochytrium ornithocephalum Clémençon; Rev. Algol., N.S., **9**: 33-37, figs. 12-20 (Pl. 5). 1969. Saprophytic; on *Spirogyra*; fishpond; Botanical garden, Bern, Switzerland

Harpochytrium tenuissimum Korschikoff; Arch. Protistenk., **74**: 249-258, figs. 21-22. 1931
Saprophytic; On *Oedogonium* sp.; Latzino-Moores; Zwenigorod, Germany
Emended by Jane; J. Linn. Soc., Bot., **53**: 28-40. 1946

Harpochytrium viride Scherffel (alga); Arch. Protistenk., **54**: 510-528. 1926

Karlingia Johanson 1944; Sparrow 1960 placed exo-operculate spp. in *Karlingiomyces*.
Karlingiomyces not accepted by Karling; Sydowia, Beiheft VI., p. 58. 1966

Karlingia aurantiaca Karling; Nova Hedwigia, **27**: 747-771, figs. 22-31. 1976
Saprophytic; corn leaves; soil; Blantyre, Malawi

Karlingia exo-operculata Karling; Nova Hedwigia, **28**: 209-229, figs. 1-16. 1976
Saprophytic; cellophane bait; soil; Orlando, FL, USA

Karlingia expandens (Salkin) Karling; Nova Hedwigia, **28**: 209-229. 1976
≡ *Allochytridium expandens* Salkin 1970; *A. expandens* preferred.

Karlingia granulata Karling not *Karlingiomyces granulatus* (Karling) Sparrow 1960
I.J. Dogma; Nova Hedwigia, **25**: 91-105. 1974

Karlingia lacustris Hassan; Nova Hedwigia, **37**: 435-440, figs. 1-7. 1983
Saprophytic; onion skin bait; Mikolajki Lake; northeast Poland

Karlingia lobata var. ***microspora*** Karling; Nova Hedwigia, **40**: 329-340, Pl. 1, figs. 1-18. 1984
Saprophytic; bleached corn cotyledons; soil; LaGuajira, Colombia, S.A.
Karlingia polonica Hassan; Nova Hedwigia, **38**: 727-740, figs.1-17, Pl. 1. 1983
Saprophytic; onion skin; water, Mlociny Park, Poland
Karlingia spinosa Karling not *Rhizophlyctis spinosa* (Karling) Sparrow 1960
I.J. Dogma; Nova Hedwigia, **25**: 91-105. 1974
Karlingiomyces Sparrow 1960; rejected by Karling; Sydowia, Beiheft VI. p. 58. 1966
Accepted by I.J. Dogma; Nova Hedwigia, **24**: 393-411. 1973
Karlingiomyces laevis Konno; Sci. Rep. Tokyo Kyoiku Daigaku Sect. B, **14**: 227-292, Pl. 8, E-H. 1972. Saprophytic; cellophane bait; forest soil; Susono-machi (Shizuoka Prefecture), Japan
KOCHIOMYCES D.J.S. Barr [**S**]; Canad. J. Bot., **58**: 2380-2394. 1980
Kochiomyces dichotomus (Umphlett) D.J.S. Barr (**IF 5**:51); Canad. J. Bot., **58**: 2380-2394. 1980
≡ *Phlyctochytrium dichotomum* Umphlett 1967
LACUSTROMYCES Longcore [**C**]; Canad. J. Bot., **71**: 414-425. 1993
Lacustromyces hiemalis Longcore; Canad. J. Bot., **71**: 414-425, figs. 1-42. 1993
Saprophytic; chitin; lakes; Maine, USA
Macrochytrium botrydiella in S.N. Dasgupta; Indian Phytopathol., **35**: 215. 1982; ? *Nom. nudum*
Macrochytrium botrydioides var. ***minutum*** S.N. Dasgupta & R. John (no Latin diagnosis); Bull. Bot. Surv. India, **30**: 1-82, fig. 67. 1988.
Saprophytic; submerged pears as bait; tank; Lucknow U., India
MICROALLOMYCES Emerson & Robertson [**B**]; Amer. J. Bot., **61**: 303-317. 1974
Microallomyces dendroideus Emerson & Robertson; Amer. J. Bot., **61**: 303-317, figs. 1-13. 1974. Saprophytic; house fly bait; damp soil from dried pond; Costa Rica
Micromyces furcata Rieth; Kulturpflanze, Beiheft **3**: 286-295, Pl. 2 A-H. 1962
Parasitic; *Spirogyra longata*; Stechlinsee region; Germany
Micromyces grandis Miller 1955 ≡ *Synchytrium grandis* (Miller) Karling; "*Synchytrium*", Academic Press, NY. p. 124. 1964
MICROMYCOPSIDACEAE Subramanium; Curr. Sci., **43**: 722-723. 1974
Family not included by D.J.S. Barr; **HP**, p. 463, 1990.
Mitochytridium regale S.K.M. Hassan; Acta Mycol., **18**: 155-160, figs.1-4, Pl. I. (1982) 1986
Saprophytic; snake skin bait; pond; Lazienki Royal Garden, Warsaw, Poland
Monoblepharella placed in Monoblepharidaceae by A. Batko; **ZH**, p. 249-250. 1975
Also placed in Monoblepharidaceae, perhaps accidentally, by D.J.S. Barr, **HP**, p.463. 1990
Monoblepharis micrandra Sparrow; Trans. Brit. Mycol. Soc., **48**: 55-58, fig. 1 A-G. 1965
Saprophytic; twigs; shrubby swamp; Rifle River Recreation Area, MI, USA
Monophagus in S.N. Dasgupta; Indian Phytopathol., **35**: 215. 1982; *? nomen nudum*
Monophagus blackmanii in S.N. Dasgupta; Indian Phytopathol., **35**: 215. 1982; *? nomen nudum*
Monophagus bruhlii in S.N. Dasgupta; Indian Phytopathol., **35**: 215. 1982; *? nomen nudum*
NEOCALLIMASTIGACEAE Heath (**IF**) [**N**]; Canad. J. Bot., **61**: 295-307. 1983
Emended by Barr et al.; Canad. J. Bot., **67**: 2815-2824. 1989
NEOCALLIMASTIGALES J. Li, Heath, & Packer (**IF**); Canad. J. Bot., **71**: 393-407. 1993
Review: Li & Heath; Canad. J. Microbiol. **39**: 1003-1013. 1993
Review: Trinci et al.; Mycol. Res. **98**: 129-152. 1994
Taxonomy: Y.W. Ho & D.J.S. Barr; Mycologia, **87**: 656-678. 1995
NEOCALLIMASTIX Vavra & Joyon ex Heath [**N**]; Canad. J. Bot., **61**: 295-307. 1983
≡ *Neocallimastix* Vavra & Joyon (no Latin) ; Protistologica, **2**: 5-15, Pl. 1-6. 1966
Emended by Orpin & Munn; Trans. Brit. Mycol. Soc., **86**: 178-181, figs. 1-4. 1986
Neocallimastix frontalis (Braune) Vavra & Joyon ex Heath; Can. J. Bot., **61**: 295-307. 1983
≡ *Callimastix frontalis* Braune 1913. Lectotype: see Y.W. Ho & D.J.S. Barr; Mycologia **87**: 656-678. 1995. Y.W. Ho & D.J.S. Barr (loc. cit.) place the following in synonymy:
= *N. variabilis* Y.W. Ho & D.J.S. Barr 1993; = *N. patriciarum* Orpin & E.A. Munn 1986

Neocallimastix hurleyensis Theodorou & J. Webb; Canad. J. Bot., **69**: 1220-1224, figs. 1-7. 1991. ? = *Neocallimastix frontalis* (Braune) Heath; D.J.S. Barr: Mycotaxon, **54**: 203-214. 1995
Saprophytic; plant materials; rumen of sheep; U.K.

Neocallimastix joyonii Breton et al.; FEMS Microbiol. Lett., **58**: 309-314, figs. 1-2. 1989
≡ *Orpinomyces joyonii* (Breton et al.) Li et al. 1991
Saprophytic; straw; rumen of sheep; France.

Neocallimastix patriciarum Orpin & Munn; Trans. Brit. Mycol. Soc., **86**: 178-181, figs. 1-4. 1986. = *Neocallimastix frontalis* (Braune) Heath; D.J.S. Barr: Mycotaxon, **54**: 203-214. 1995
Saprophytic; plant tissues; rumen of sheep

Neocallimastix variabilis Y.W. Ho & D.J.S. Barr; Mycotaxon, **46**: 241-258, figs. 1-10. 1993
= *Neocallimastix frontalis* (Braune) Heath; D.J.S. Barr: Mycotaxon, **54**: 203-214. 1995
Saprophytic; guinea grass (*Panicum maximum*); rumen of *Bos indicus*; peninsular Malaysia

Nephrochytrium bipes Hassan; Nova Hedwigia, **38**: 727-740, figs. 18-28, Pl. 2. 1983
Saprophytic; onion skin; pond; near Warsaw, Poland

Nephrochytrium buttermerense Willoughby; Nova Hedwigia, **3**: 439-444, Pls. 114-116. 1961
≡ *Diplophlyctis buttermerense* (Willoughby) I.J. Dogma 1969
Not *D. butermerense* (Willoughby) I.J. Dogma; A. Batko; **ZH**, p. 220. 1975
Saprophytic; cellophane bait; submerged mud; Buttermere, E.L.D., U.K.

Nephrochytrium complicatum Willoughby; Nova Hedwigia, **3**: 439-444, Pls. 112, 113. 1961
≡ *Diplophlyctis complicata* (Willoughby) I.J. Dogma 1974;
combination also made by A. Batko; **ZH**, p. 186. 1975
Saprophytic; chitin bait; submerged lake mud; Ennerdale, E.L.D., U.K.

Nephrochytrium sexuale (Haskins) A. Batko; **ZH**, p. 220. 1975 ≡ *Diplophlyctis sexualis* Haskins 1950

Nowakowskiella crassa Karling 1949; = *Nowakowskiella elegans* (Nowakowski) Schroeter 1893. See T.W. Johnson; Mycologia, **69**: 34-45, 1977

Nowakowskiella delica Whiffen 1943 = *Nowakowskiella elegans* (Nowakowski) Schroeter 1893
See T.W. Johnson; Mycologia, **69**: 34-45, 1977

Nowakowskiella elegans (Nowakowski) Schroeter 1893 = *N. crassa* Karling 1949,
= *N. delica* Whiffen 1943, = *N. endogena* Constantineau 1901, and = *N. profusa* Karling 1944
See T.W. Johnson; Mycologia, **69**: 34-45. 1977

Nowakowskiella granulata Karling 1944 ≡ *Cladochytrium granulatum* (Karling) Sparrow 1960
Karling (Sydowia, Beiheft VI., p. 66. 1966) did not agree with placement in *Cladochytrium*.

Nowakowskiella keratinophila S.K.M. Hassan & A. Batko; Acta Mycol., **22**: 193-196, figs. 1-7. 1986 (1988). Saprophytic; snake skin bait; brackish water; Bay Zalew Wislany, Poland

Nowakowskiella methistemichroma A. Batko & S.K.M. Hassan; & **key** to *Nowakowskiella* spp. Sydowia, **35**: 27-36, figs. 1-21, 1982
Saprophytic; onion skin bait; water and mud; Kampinos National Park, Poland

Nowakowskiella moubasherana S.K.M. Hassan (**IF 5**:397); Acta Mycol., **19**: 77-82, figs. 1-18 & Pl. I. 1983. Saprophytic; onion skin bait; *Sphagnum* bog water; near Warsaw, Poland

Nowakowskiella multispora Karling; Sydowia, **17**: 314-319, figs.1-8. 1964
Saprophytic; corn leaves and cellophane; soil, dry catch basin; Rhamnad Dist., India

Nowakowskiella pitcairnensis Karling; Nova Hedwigia, **15**: 191-201, figs. 1-19. 1968
Saprophytic; hemp seed bait; soil; Pitcairn, Oceania

Nowakowskiella profusa Karling 1944 = *Nowakowskiella elegans* (Nowakowski) Schroeter 1893; See T.W. Johnson; Mycologia, **69**: 34-45. 1977

Nowakowskiella profusa forma ***constricta*** Kobayasi & Konno; Bull. Natl. Sci. Mus., **14**: 373-386, fig. 3 A-B. 1971. Saprophytic; cellophane; soil; Papua, Territory of New Guinea and Solomon Islands

Nowakowskiella sculptura Karling; Trans. Brit. Mycol. Soc., **44**: 453-457, figs. 1-24. 1961
Saprophytic; cellophane bait; soil; Baton Rouge, LA, USA.

Obelidium megarhizum Willoughby; Trans. Brit. Mycol. Soc., **44**: 586-592, fig. 1, Pl. 37. 1961
Saprophytic; termite wings; submerged mud; Malham Tarn, U.K.

OEDOGONIOMYCETACEAE D.J.S. Barr [**M**]; **HP**, p. 463. 1990

Oedogoniomyces from Harpochytriales to Monoblepharidales; D.J.S. Barr: **HP**, p. 463. 1990

Olpidium (Braun) Rabenhorst 1868 = *Pleotrachelus* Zopf 1884; Karling: **CI**, p. 14. 1977
D.J.S. Barr placed *Olpidium* in Spizellomycetales; Canad. J. Bot., **58**: 2380-2394. 1980

Olpidium appendiculatum Karling; Sydowia, **19**: 213-226, Pl. 46, figs. 1-13. 1965
Saprophytic; pollen; sand & moss; near glacier, Antarctica

Olpidium bornovanus (Sahtiyanci) Karling; **CI**, p. 13. 1977; ≡ *Pleotrachelus bornovanus* Sahtiyanci 1962; = *O. radicale*; Lange & Insunza; Trans. Brit. Mycol. Soc. **69**: 377-384. 1977 = *O. cucurbitacearum* Barr & Dias; Campbell & Sim; Canad. J. Bot., **72**: 1136-1143. 1994

Olpidium brassicae (Woronin) Dangeard ≡ *Pleotrachelus brassicae* (Woronin) Sahtiyanci; Arch. Mikrobiol., **41**: 187-228. 1962

Olpidium cucurbitacearum D.J.S. Barr and Dias; Canad. J. Bot., **46**: 1087-1091, figs. 1-12 & 13-22. 1968. = *Olpidium radicale* as redescribed, Lange & Insunza; Trans. Brit. Mycol. Soc., **69**: 377-384. 1977. = ***O. bornovanus*** **(Sahiyanci) Karling** 1962; see Campbell & Sim; Canad. J. Bot., 72: 1136-1143. 1994. Parasitic; cucumber roots; soil; southern Ontario, Canada

Olpidium entophlyctoides in S.N. Dasgupta; Indian Phytopathol., **35**: 215. 1982; ? *nomen nudum*

Olpidium fulgens (Zopf) Karling; **CI**, p. 18. 1977; ≡ *Pleotrachelus fulgens* Zopf 1892

Olpidium incognitum S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, figs. 5-6. 1988
Parasitic; egg of rotifer; tank sediment; Lucknow U., India

Olpidium indicum Karling (homonym); Sydowia, **17**: 302-307, figs. 1-21. 1964
≡ *Olpidium indum* Karling 1966
Parasitic; *Catenophlyctis variabilis* & *Rhizophlyctis fuscus*; soil; Rhamnad Dist., India

Olpidium indicum Kiran & Dyal (homonym & type not indicated); Proc. Natl. Acad. Sci, India, Sect. B. **62**: 295-298, fig. 2. 1992
Parasitic; root hairs of angiosperms; pond; Ramkatora, Varanasi, U.P., India

Olpidium indum Karling; Sydowia, Beiheft VI, p.6. 1966; ≡ *Olpidium indicum* Karling 1964

Olpidium longum S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, figs. 2-4. 1988
Parasitic; eggs of animicules; tank sediment; Lucknow U., India

Olpidium nematodae Skvortzow; Tribe (Trans. Brit. Mycol. Soc., **69**: 509-511. 1977) refutes Sparrow 1960 interpretation.

Olpidium poreferum Kiran and Dyal (invalid; type not designated); Proc. Natl. Acad. Sci., India, Sect. B, **62**: 295-298, Pl. 1, fig. 1. 1992.
Parasitic; rotifers; pond, Agricultural Farm; B.H.U., U.P., India

Olpidium pseudoeuglenae S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 7. 1988. Parasitic; chytrid on *Closterium*; tank sediment; Lucknow U., India

Olpidium radicale Schwartz & Cook; redescribed by Lange & Insunza; Trans. Brit. Mycol. Soc., **69**: 377-384. 1977. = *O. cucurbitacearum* D.J.S. Barr and Diaz 1968; Campbell & Sim (Canad. J. Bot. **72**: 1136-1143. 1994) consider *O. radicale* a *nomen dubium* and accept *O. bornovanus* (Sahtiyanci) Karling.

Olpidium rostriferum var. ***indica*** Kiran & Dayal (invalid; type not designated); Proc. Natl. Acad. Sci., India, Sect. B, **62**: 295-298, fig. 3. 1992
Saprophytic; leaf of angiosperm; pond; Ramkatora, U.P., India

Olpidium sparrowii I.J. Dogma; & table of *Olpidium* spp. parasitic on rotifers; Philipp. J. Biol., **6**: 9-20, figs. 1-16. 1977; Parasitic; rotifer eggs; cultivated soils; Putiao, Luzon, Philippines

Olpidium synchytrii Karling; Mycologia, **50**: 944-947, figs. 1-7. 1958
Parasitic; *Synchytrium namae* on *Nama jamaicensis* plants; Texas, USA

Olpidium vermicola G.L. Barron & E. Szijarto; Mycologia, **78**: 972-975, figs. 1-12. 1986
Parasitic; nematode eggs; old stump; Lake Manitowabing, Ontario, Canada

Olpidium virulentus (Sahtiyanci) Karling; **CI**, p. 13, 1977 ≡ *Pleotrachelus virulentus* Sahtiyanci 1962

Olpidium wildemani (Petersen) Karling; **CI**, p. 18, 1977 ≡ *Pleotrachelus wildemani* Petersen 1910

Olpidium zopfianus (Morini) Karling; **CI**, p. 18, 1977; ≡ *Pleotrachelus zopfianus* Morini 1913

ORPINOMYCES D.J.S. Barr & H. Kudo [N]; Canad. J. Bot., **67**: 2815-2824. 1989
Emended by Y.W. Ho & D.J.S. Barr; Mycologia, **87**: 656-678. 1995
Orpinomyces bovis D.J.S. Barr & H. Kudo; Canad. J. Bot., **67**: 2815-2824. figs. 37-51. 1989
= *Orpinomyces joyonii* (Breton et al.) Li et al. 1991
Saprophytic; plant material; digestive tract of herbivores; Lethbridge, Alberta, Canada
Orpinomyces intercalaris Y.W. Ho; Mycotaxon, **50**: 139-150, figs. 1-10. 1994
Saprophytic; guinea grass (*Panicum maximum*); rumen of cattle (*Bos indicus*); Malaysia
Orpinomyces joyonii (Breton et al.) Li et al.; Canad. J. Bot., **69**: 580-589. 1991
= *O. bovis* Barr & H. Kudo 1989; ≡ *Neocallimastix joyonii* Breton et al. 1989
Lectotype: see Y.W. Ho & D.J.S. Barr; Mycologia, **87**: 656-678. 1995
Phlyctidium (Braun) Rabenhorst 1868 = *Rhizophydium* Schenk 1858
Karling; **CI**, Pp. 64-65. 1977
Phlyctidium anatropum (Braun) Rabenhorst 1856 ≡ *Rhizophydium anatropum* (Braun) Karling; **CI**, p. 65. 1977
Phlyctidium apophysatum Canter 1947 emended by H. Canter; Trans. Brit. Mycol. Soc., **44**: 522-528, figs. 1-3 & Pl. 34, figs.1-10. 1961. ≡ *Canteria apophysata* (Canter) Karling 1971
Parasitic; *Mougeotia*; E.L.D., U.K.
Phlyctidium brevipes var. ***marinum*** Kobayasi & Ookubo 1954 ≡ *Rhizophydium brevipes* var. *marinum* (Kobayasi & Ookubo) Karling; **CI**, p. 65, 1977
Phlyctidium bumilleriae Couch 1932 ≡ *Rhizophydium bumilleriae* (Couch) Karling; **CI**, p. 65. 1977
Phlyctidium globosum Skuja 1956 ≡ *Rhizophydium skujai* (Skuja) Karling; **CI**, p. 64. 1977
Phlyctidium keratinophilum Ookubo and Kobayasi 1955 ≡ *Rhizophydium ellipsoidium* (Ookubo & Kobayasi) Karling; **CI**, p. 64. 1977
Phlyctidium keratinophilum var. ***savulescui*** Cejp; Omagiu lui Traian Savulescu (Bucuresti), 129-138, fig. 1. 1959. Saprophytic; human hair; rill; pasture near Rokycany, Romania
Phlyctidium marinum Karling; Sydowia, **20**: 74-84, Pl. XII, figs. 1-8. 1967
≡ *Rhizophydium novae-zelandiensis* (Karling) Karling; **CI**, p. 65. 1977
Saprophytic; *Pinus* pollen; beach sand + sea water; Aukland, N.Z.
Phlyctidium mycetophagum Karling 1946 ≡ *Rhizophydium obypriformis* (Karling) Karling; **CI**, p. 64. 1977
Phlyctidium olla Sparrow 1933; ≡ *Rhizophydium olla* (Sparrow) Karling; **CI**, p. 65. 1977
Phlyctidium scenedesmi Fott; Z. Allg. Mikrobiol., **7**: 97-102, figs. 1-16. 1967
≡ *Rhizophydium scenedesmi* (Fott) Karling; **CI**, p. 65. 1977
Parasitic; *Scenedesmus quadricauda* in mass culture; water; Trebon, Czechoslovakia
Phlyctidium spinulosum Sparrow 1933 ≡ *Rhizophydium spinulosum* (Sparrow) Karling; **CI**, p. 65. 1977
Phlyctidium tenue Sparrow 1952 ≡ *Rhizophydium tenue* (Sparrow) Karling; **CI**, p. 65. 1977
Phlyctidium tubulatum in S.N. Dasgupta; Indian Phytopathol., **35**: 215. 1982; *? nomen nudum*
Phlyctochytrium acuminatum D.J.S. Barr; Canad. J. Bot., **47**: 991-997, figs. 71-82. 1969
≡ *Spizellomyces acuminatus* (D.J.S. Barr) D.J.S. Barr 1984
Saprophytic; pine pollen; soil; southwestern Ontario, Canada
Phlyctochytrium aestuarii Ulken; Veröff. Inst. Meeresforsch. Bremerhaven, **13**: 205-216, figs. 5 & 6. 1972 ≡ *Rhizophydium aestuarii* (Ulken) Amon 1984
Saprophytic; pine pollen; river mud; Weser Estuary, Germany
Phlyctochytrium africanum Gaertner 1954 (not validly published) = *Spizellomyces acuminatus* (D.J.S. Barr) D.J.S. Barr; Canad. J. Bot., **62**: 1171-1201. 1984
Phlyctochytrium apophysatum S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 36. 1988. Saprophytic ?; *Closterium*; tank; garden, Lucknow U., India
Phlyctochytrium arcticum D.J.S. Barr; Canad. J. Bot., **48**: 2279-2283, figs.1-17. 1970
≡ *Triparticalcar arcticum* D.J.S. Barr 1984
Saprophytic; pollen; soil, pH 7.9; Canadian Arctic

Phlyctochytrium aureliae Ajello 1945 = *Phlyctochytrium variable* 1954; T.W. Johnson; Norw. J. Bot., **22**: 249-257. 1975

Phlyctochytrium californicum D.J.S. Barr; Canad. J. Bot., **47**: 991-997, figs. 23-33. 1969
= *Gaertneriomyces semiglobiferus* (Uebelmesser) D.J.S. Barr 1980
Saprophytic; pine pollen; soil; CA, USA

Phlyctochytrium chandleri Sparrow (**IF 4**:385); Arch. Microbiol., **104**: 39-49, figs. 6-9. 1975
Saprophytic; pollen; soil; oasis, Tunisia

Phlyctochytrium circulidentatum Koch; In Umphlett & Koch; Mycologia, **61**: 1021-1030, figs. 1-3, 11-17. 1969. Saprophytic; pollen and moribund *Closterium*; bottom debris; Ravenal Lake, NC, USA

Phlyctochytrium cystoferum Willoughby; Arch. Mikrobiol., **52**: 101-131, fig. 1 a-h. 1965
≡ *Polyphlyctis cystofera* (Willoughby) A. Batko; **ZH**, p. 183. 1975
Saprophytic; grass leaf bait; soil from heath; Victoria, Australia

Phlyctochytrium dichotomum Umphlett; Mycologia, **59**: 1085-1096, figs. 1-41. 1967
≡ *Kochiomyces dichotomus* (Umphlett) D.J.S. Barr 1980
Saprophytic; sweet gum pollen; soil + sawdust; Chatham Co., NC, USA

Phlyctochytrium dissolutum S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 37. 1988. Saprophytic ?; *Closterium*; tank; garden, Lucknow U., India

Phlyctochytrium furcatum Sparrow; Arch. Mikrobiol., **53**: 178-180, figs. 1-9. 1966
Saprophytic; pine pollen; almost dry bog with *Vaccinium*; MI, USA

Phlyctochytrium hirsutum Karling; Sydowia, **20**: 86-95, figs. 3-10. 1967
Saprophytic; purified shrimp chitin; soil; N.Z.

Phlyctochytrium incrustans Sparrow & Lange; Canad. J. Bot., **55**: 1879-1890, figs. 19-22. 1977
Saprophytic; pine pollen; bog; Emmet Co., MI, USA

Phlyctochytrium indicum Karling; Sydowia, **17**: 285-296, figs. 16-31. 1964
Saprophytic; pine pollen; brackish soil; Rhamnad District, Madras, India

Phlyctochytrium irregulare Koch; J. Elisha Mitchell. Sci. Soc., **73**: 108-122, figs. 13-24. 1957
Saprophytic; *Liquidambar* pollen and *Paspalum* leaves bait; wet soils; NC, USA

Phlyctochytrium kniepii Gaertner 1954 (not validly published) ≡ *Spizellomyces kniepii* Gaertner ex D.J.S. Barr; Canad. J. Bot., **62**: 1171-1201. 1984

Phlyctochytrium lackeyi Sparrow; Mycologia, **68**: 1233-1234, figs. 1-4. 1976
Saprophytic; pollen; Punch Bowl; Milford, FL, USA

Phlyctochytrium macrosporum Sparrow; Mycologia, **70**: 140-149, figs. 1-14. 1978
Parasitic?; live pine pollen; neuston; Newnan's Lake, FL, USA

Phlyctochytrium mangrovii Ulken; Veröff. Inst. Meeresforsch. Bremerhaven, **13**: 217-230, figs. 1, 2. 1972. Saprophytic; pine pollen & cattle hair; mangrove muds; Cananeia, Sao Paulo, Brazil

Phlyctochytrium marilandicum Sparrow; Mycologia, **65**: 1331-1336, figs. 1-11. 1973
Saprophytic; pollen; woodland soil; MD, USA

Phlyctochytrium megastomum Karling; Mycopathol. Mycol. Appl., **36**: 165-178, figs. 1-17. 1968 = *P. irregularis* Koch 1957 (Sparrow opinion, unpublished)
Saprophytic; bleached corn leaves; soil; Rarotonga, Cook Islands

Phlyctochytrium mucosum Sparrow & I.J. Dogma; Arch. Mikrobiol., **89**: 177-204, fig. 1, J-M. 1973. Saprophytic; pine pollen bait; soil; Dominican Republic

Phlyctochytrium multidentatum Umphlett; Mycologia, **61**: 1021-1030, figs. 4-10. 1969
Saprophytic; sweet gum pollen; soil & water; Chapel Hill, NC, USA

Phlyctochytrium neuhausiae Sparrow (**IF 4**:417) ; Proc. Iowa Acad. Sci., **81**: 2-5, figs. 10-14. 1974. Saprophytic; pine pollen; soil; Delphi, Greece

Phlyctochytrium palustre Gaertner 1954 (not validly published) ≡ *Spizellomyces palustris* Gaertner ex D.J.S. Barr; Canad. J. Bot., **62**: 1171-1201. 1984

Phlyctochytrium parasitans Sparrow & I.J. Dogma; Arch. Mikrobiol., **89**: 177-204, fig. 2, T-U. 1973. Parasitic; eggs of *Achlya flagellata*; damp soil; Carretara Duarte, Hispaniola

Phlyctochytrium peruvianum Knox (not validly published) PhD thesis, VPI, Blacksburg, VA. 1970. = *Spizellomyces punctatus* (Koch) D.J.S. Barr 1984

Phlyctochytrium planicorne Atkinson 1909 emended by Umphlett & Holland; Mycologia, **52**: 429-435. 1960; = *Rhizophydium digitatum* Scherffel 1926; T.W. Johnson: Norw. J. Bot., **22**: 249-257. 1975

Phlyctochytrium plurigibbosum D.J.S. Barr; Canad. J. Bot., **47**: 991-997, figs. 44-52. 1969 ≡ *Spizellomyces plurigibbosus* (D.J.S. Barr) D.J.S. Barr 1984
Saprophytic; pine pollen; soil; Ottawa, Ontario, Canada

Phlyctochytrium powhatanense Roane (**IF 4**:250); Mycologia, **65**: 531-538, figs. 1-2, 15-20. 1973. Saprophytic; rotifer, chitin, snake skin; impoundment; Pulaski Co., VA, USA

Phlyctochytrium punctatum Koch; J. Elisha Mitchell. Sci. Soc., **73**: 108-122, figs. 1-16. 1957 ≡ *Spizellomyces punctatus* (Koch) Barr 1984
Saprophytic; *Liquidambar* and pine pollen bait; soil; New Guinea

Phlyctochytrium recurvastomum Knox & Paterson; Mycologia, **65**: 373-387, figs. 11-18. 1973
Saprophytic; pollen; soil; McMurdo area, Antarctica

Phlyctochytrium reinboldtae Persiel; Arch. Mikrobiol. **32**: 411-415, fig. 1. 1959
Saprophytic; pine pollen; soil ; Botanical Garden, Göttingen, Germany

Phlyctochytrium semiglobiferum Uebelmesser 1956 ≡ *Gaertneriomyces semiglobiferus* (Uebelmesser) D.J.S. Barr; Canad. J. Bot., **58**: 2380-2394. 1980

Phlyctochytrium spinosum Sparrow; Mycologia, **65**: 1331-1336, figs. 12-16. 1973
Saprophytic; pollen ?; soil from spring-fed meadow; HI, USA

Phlyctochytrium variable Rieth 1954; = *Phlyctochytrium aureliae* Ajello 1945; see T.W. Johnson; Norw. J. Bot., **22**: 249-257. 1975

Phlyctochytrium vaucheriae Rieth 1956 ≡ *Blyttiomyces vaucheriae* (Rieth) I.J. Dogma; Mycologia, **61**: 1149-1158. 1969

Phlyctochytrium verruculosum Knox (not valid pub.) PhD thesis, VPI, Blacksburg, VA. 1970 = *Spizellomyces punctatus* (Koch) D.J.S. Barr ; Canad. J. Bot., **58**: 2380-2394. 1980

Phlyctorhiza variabilis Karling 1947 ≡ *Entophlyctis variabilis* (Karling) Cejp; Omagiu lui Traian Săvulescu, 129-138. 1959; ≡ *Catenophlyctis variabilis* (Karling) Karling; Amer. J. Bot., **52**: 133-138. 1965

Physodermataceae; transferred from Chytridiales to Blastocladiales by Lange & Olson; Trans. Brit. Mycol. Soc., **74**: 449-457. 1980

PIROMYCES Gold, Heath & Bouchop [**N**]; Biosystems, **21**: 403-415. 1988 = *Piromonas communis* sensu Orpin; J. Gen. Microbiol., **99**: 107-117. 1977

Piromyces communis Gold, Heath & Bauchop; BioSystems, **21**: 403-415, (figs. 1-10 in Orpin; J. Gen. Microbiol., **99**: 107-117. 1977). 1988 ≡ *Piromonas communis* sensu Orpin 1977
Saprophytic; plant material; rumen of sheep

Piromyces dumbonicus J. Li (**IF**); Canad. J. Bot., **68**: 1021-1033, figs. 2, 4, 9, 12, 13, 19, 23, 24, 31. 1990; Saprophytic; cellulose; gut of elephant; New Zealand

Piromyces mae J. Li; Canad. J. Bot., **68**: 1021-1033, figs. 1, 3, 5-8, 10, 11, 15-16, 20-22, 25-30, 32. 1990. Saprophytic; plant material; caecum of horse; New Zealand

Piromyces minutus Y.W. Ho; Mycotaxon, **47**: 285-293, figs. 1-14. 1993
Saprophytic; guinea grass (*Panicum maximum*); rumen of Sika deer (*Cervus nippon*); Malaysia

Piromyces rhizinflatus Breton et al. (**IF 6**:445); FEMS Microbiol. Lett., **82**: 1-8, figs. 1-2. 1991
Lectotype: see Y.W. Ho & D.J.S. Barr; Mycologia, **87**: 656-678. 1995
Saprophytic; culture; dried faeces of Saharian ass; Tunisia

Piromyces spiralis Y.W. Ho; Mycotaxon, **48**: 59-68, figs. 1-14. 1993.
Saprophytic; grass (*Panicum maximum*); rumen of katjang goat (*Capra hircus*); Malaysia

Pleotrachelus Zopf 1884; = *Olpidium* (Braun) Rabenhorst 1868; Karling, **CI**, p. 14. 1977

Pleotrachelus askaulos Bradley (fossil); Amer. J. Bot., **54**: 577-582, fig. 8. 1967
Eocene Green River Formation; Wyoming, USA

Pleotrachelus bornovanus Sahtiyanci; Arch. Mikrobiol., **41**: 187-228, figs. 50-79. 1962. ≡ *Olpidium bornovanus* (Sahtiyanci) Karling; **CI**, p. 13. 1977; = *O. radicale* (*sensu* Lange & Insunza 1977); = *O. cucurbitacearum* D.J.S. Barr & Dias 1968; See Campbell & Sim; Canad. J. Bot., **72**: 1136-1143. 1994. Parasitic; *Lactuca, Spinacea, Beta, Nicotiana, Solanum* et al.; soil

Pleotrachelus brassicae (Woronin) Sahtiyanci; Arch. Mikrobiol. **41**: 187-228. 1962 ≡ *Olpidium brassicae* (Woronin) Dangeard; maintained as *O. brassicae* by Karling; **CI**, p. 18. 1977

Pleotrachelus virulentus Sahtiyanci; Arch. Mikrobiol., **41**: 187-228, figs. 24-49. 1962 ≡ *Olpidium virulentus* (Sahtiyanci) Karling; **CI**, p. 13. 1977 Parasitic; *Lactuca, Solanum, Beta, Nicotiana, Capsella*

Pleotrachelus wildemanni Petersen 1910 ≡ *Olpidium wildemanni* (Petersen) Karling; **CI**, p. 18. 1977

Pleotrachelus zopfianus Morini 1913 ≡ *Olpidium zopfianus* (Morini) Karling; **CI** p. 18. 1977

Podochytrium chitinophilum Willoughby; Trans. Brit. Mycol. Soc., **44**: 586-592, fig. 2, Pl. 38. 1961. Saprophytic; termite wings; Wastwater; E.L.D., U.K.

Podochytrium dentatum Longcore; Mycologia, **84**: 183-192, figs. 1-29. 1992 Saprophytic; chitin; lake, circumneutral pH; Maine, USA

Podochytrium ellerbeckense Willoughby; Nova Hedwigia, **5**: 335-340, Pl. 53 a-w. 1963 Saprophytic; waterlily leaf stalks; garden pond; E.L.D., U.K.

Polyphagus asymmetricus Valkanov (no Latin diagnosis); Arch. Protistenk., **106**: 565-568, Pl. 44. 1963. Parasitic; *Botrydiopsis*; hyponeuston; southern Bulgaria

Polyphagus elegans Canter; Nova Hedwigia, **5**: 419-428, Pls. 74-76. 1963 Parasitic; *Ulothrix mucosum*; plankton; Windermere, E.L.D., U.K.

Polyphagus hyponeustonica (Valkanov) Karling; **CI**, p. 174. 1977 (sp. not validated) ≡ *Arnaudovia hyponeustonica* Valkanov 1963 (no Latin diagnosis)

Polyphagus serpentinus Canter; Nova Hedwigia, **5**: 419-428, Pls. 71-73. 1963 Parasitic; *Spondylosium* spp.; lakes; E.L.D., U.K.

Polyphagus starrii Johns; Mycologia, **56**: 441-451, figs. 1-6. 1964 Parasitic; *Eudorina, Pandorina*, et al.; Stonewall Pond; MA, USA

POLYPHLYCTIS Karling [C]; Sydowia, **20**: 86-95. 1967

Polyphlyctis cystofera (Willoughby) A. Batko; **ZH**, p. 183. 1975 ≡ *Phlyctochytrium cystoferum* Willoughby 1965

Polyphlyctis unispina (Paterson) Karling; Sydowia, **20**: 86-95. 1967 ≡ *Phlyctochytrium unispinum* Paterson 1956

POWELLOMYCES Longcore, D.J.S. Barr & N. Désaulniers [S]; Canad. J. Bot. **73**: 1385-1390. 1995

Powellomyces hirtus Longcore, D.J.S. Barr & N. Désaulniers; Canad J. Bot. **73**: 1385-1390, figs. 1-18. 1995. Saprophytic; pollen bait; soil; Ontario, Canada

Powellomyces variabilis Powell & Koch ex Longcore, D.J.S. Barr & N. Désaulniers; Canad. J. Bot. **73**: 1385-1390. 1995. ≡ *Entophlyctis variabilis* Powell & Koch 1977 not *E. variabilis* (Karling) Cejp 1959

Pringsheimiella dioica Couch 1939 (homonym and no Latin diagnosis) ≡ *Dictyomorpha dioica* Couch ex Mullins; Amer. J. Bot., **48**: 377-387. 1961

PSEUDOPILEUM Canter [C]; Trans. Brit. Mycol. Soc., **46**: 305-320. 1963

Pseudopileum unum Canter; Trans. Brit. Mycol. Soc., **46**: 305-320, fig. 3. 1963 Parasitic; cysts of *Mallomonas* sp.; plankton of Elterwater; E.L.D., U.K.

Rhizidium endosporangiatum Karling; Mycopathol. Mycol. Appl., **36**: 165-178, figs. 18-37. 1968. Saprophytic; bleached corn leaves & pollen; soil sample; Pitcairn & Niue, Oceania

Rhizidium megastomum Sparrow; Mycopathol. Mycol. Appl., **25**: 119-143, figs. 19-23. 1965 Saprophytic; snake skin; soil; Oahu, HI, USA

Rhizidium microcystidis Sen; Arch. Hydrobiol. (Suppl.), **79**: 177-184, figs. 1, 2. 1988 Parasitic; *Microcystis aeruginosa* (Cyanobacteria); Shearwater; Wiltshire, U.K.

Rhizidium parasiticum in S.N. Dasgupta; Indian Phytopathol., **35**: 215. 1982; ? *nomen nudum*

Rhizidium renifore Karling (**IF** 4:43); Arch. Mikrobiol., **70**: 266-287, fig. 1 A-O. 1970
Saprophytic; purified shrimp and lobster chitin; soil sample; Auckland Province, N.Z.
Rhizidium tomiyamanum Konno; J. Jap. Bot., **44**: 315-317, figs. A-H. 1969
Saprophytic; *Porphyra*, pine pollen bait; marine; ? Japan
Rhizoclosmatium hyalinum Karling; Sydowia, **20**: 96-108, figs. 48-59. 1967
Saprophytic; exuviae and chitin bait; water in outdoor tub; U. of Otago, N.Z.
Rhizophlyctis A. Fischer 1892 *sensu* Sparrow 1960; I.J. Dogma designated *R. mastigotrichis* (Nowakowski) Fischer as lectotype; Nova Hedwigia, **24**: 393-411. 1973; but Dogma's lectotype was predated by designation of *R. rosea* (De Bary & Woronin) Fischer in Clements & Shear; *The Genera of Fungi*, p. 235. 1931.
Rhizophlyctis aurantiaca I.J. Dogma; Nova Hedwigia, **25**: 51-89, Pls. I-III. 1974
Saprophytic; chitin; soil; Annapolis, MD, USA
Rhizophlyctis boninensis Kobayasi & Konno; Bull. Natl. Sci. Mus., **12**: 725-733, fig. 3 L-Q. 1969. Saprophytic; ? cellophane; soil; Chichijima, Bonin Islands
Rhizophlyctis bonseyi Sparrow; Mycopathol. Mycol. Appl., **25**: 119-143, figs. 29-54. 1965
Saphrophytic; chitin; soil, margin of reservoir; Maui, HI, USA
Rhizophlyctis columellae S.N. Dasgupta & R. John; Indian Phytopathol., **43**: 564-567, fig. 1. 1990 (1991). Parasitic; zygospore of *Spirogyra* sp.; tank; Lucknow U., India
Rhizophlyctis costatus Konno; Sci. Rep. Tokyo Kyoiku Daigaku Sect. B, **14**: 227-292, Pl. 8 A-D. 1972. Saprophytic; cicada wings; forest soil; Ohdaigahara (Nara Prefecture), Japan
Rhizophlyctis fuscus Karling (**IF** 3:310); Mycopathol. Mycol. Appl., **23**: 215-222, figs. 12-21. 1964. Saprophytic; human & snake skin, corn leaf; soil; Madras, India
Rhizophlyctis hirsutus Karling; Mycopathol. Mycol. Appl., **23**: 215-222, figs. 22-26. 1964
Saprophytic; skin, corn leaves, hemp seed; soil; dry rice paddy, Madras, India
Rhizophlyctis ingoldii Sparrow; Trans. Brit. Mycol. Soc., **40**: 523-535, fig. 1 F-K. 1957
Saprophytic; chitin bait; soil; widespread, U.K. (in Sparrow 1960 as footnote)
Rhizophlyctis lovettii Karling (**IF** 3:310); Mycopathol. Mycol. Appl., **23**: 215-222, figs. 1-11. 1964. Saprophytic; human fibrin film; soil; Madras, India
Rhizophlyctis oceanis Karling; Amer. J. Bot., **56**: 211-221 figs. 1-108. 1969
Saprophytic; purified shrimp chitin; soil; Pitcairn et al. Islands, Oceania
Rhizophlyctis oceanis var. ***floridaensis*** Karling; Nova Hedwigia, **28**: 209-229, figs. 17-28. 1976
Saprophytic; chitin; soil, flower garden; FL, USA
Rhizophlyctis petersenii var. ***appendiculata*** Karling; Sydowia, **20**: 96-108, figs. 60-67. 1967
Saprophytic; corn leaves and chitin; soil and water; N.Z.
Rhizophlyctis reynoldsii I.J. Dogma; Nova Hedwigia, **25**: 51-89, Pl. VII., figs. 1-19. 1974
Saprophytic; chitin; leaf litter; Rangoon, Burma
Rhizophlyctis serpentina I.J. Dogma (**IF** 4:318); Nova Hedwigia, **25**: 51-89, Pl. IV-VI, figs. 1-45. 1974. Saprophytic; chitin bait; soil & leaf litter; widespread, Cameroon
Rhizophlyctis tropicalis Sparrow & I.J. Dogma; Arch. Mikrobiol., **89**: 177-204, fig. 4, A-M. 1973. Saprophytic; lens paper and onion skin baits; soil; Dominican Republic
Rhizophlyctis variabilis Karling; Sydowia, **20**: 96-108, figs. 68-81. 1967
Saprophytic; bleached corn leaves; soil; N.Z.
Rhizophlyctis variabilis var. ***burmaensis*** I.J. Dogma; Nova Hedwigia, **25**: 51-89, Pl. VIII, figs. 1-20. 1974. Saprophytic; chitin; soil & leaf litter; Burma
Rhizophlyctis willoughbyi Konno; Sci. Rept. Tokyo Kyoiku Daigaku Sect. B, **14**: 227-292. Pl. 7 A-D. 1972. Saprophytic; bee wings, cicada wings, & snake skin; soils; widespread, Japan
Rhizophydium Schenk; all *Phlyctidium* spp. into *Rhizophydium*; Karling; **CI**, p. 64. 1977
Rhizophydium achnanthis Friedmann 1952 ≡ *Hapalopera achnanthis* (Friedmann) A. Batko; **ZH**, p. 170. 1975
Rhizophydium aestuarii (Ulken) Amon; Mycologia, **76**: 132-139. 1984 ≡ *Phlyctochytrium aestuarii* Ulken 1972
Rhizophydium anatropum (Braun) Karling; **CI**, p. 65. 1977 ≡ *Phlyctidium anatropum* Braun 1856

Rhizophydium androdioctes Canter; Trans. Brit. Mycol. Soc., **56**: 115-120, figs. 1-19. 1971
Parasitic; *Dictyosphaerium pulchellum* (Green alga); Loch Leven; Kinross, Scotland
Rhizophydium angulosum Karling; Arch. Mikrobiol., **61**: 112-127, fig. 1 M-X. 1968
Saprophytic; pollen and bleached corn leaves; many soil collections; Oceania
Rhizophydium annulatum Sparrow; Canad. J. Bot., **55**: 1501-1504, figs.1-6. 1977
Saprophytic; pine pollen; Punch Bowl; Melrose, FL, USA
Rhizophydium aphanomycis Karling; Nova Hedwigia, **27**: 747-771, figs. 12-21. 1976
Parasitic; *Aphanomyces* sp.; soil; Ngorongora Crater, Tanzania
Rhizophydium aureum Konno; Sci. Rep. Tokyo Kyoiku Daigaku Sect. B, **14**: 227-293, Pl.3, figs. A-D. 1972. Saprophytic; snake skin, bee wings, & cicada wings; soil; Tsu-shima, Bonin Island, Japan
Rhizophydium biporosum (Couch) D.J.S. Barr; Canad. J. Bot., **51**: 967-975. 1973
≡ *Phlyctochytrium biporosum* Couch 1932; = *Phlyctidium bumilleriae* Couch 1932
Rhizophydium blastocladianum S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 16. 1988. Parasitic; *Blastocladia* on apple; tank sediment; Lucknow U., India
Rhizophydium blyttiomycerum S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 24. 1988. Parasitic; *Blyttiomyces spinosus* & zygospore of *Spirogyra*; ditch; Sultanpur Road, SE of Lucknow U., India
Rhizophydium brevipes var. ***marinum*** (Kobayasi & Ookubo) Karling; 1977., p. 65
≡ *Phlyctidium brevipes* var. *marinum* Kobayasi & Ookubo 1954
Rhizophydium bumilleriae (Couch) Karling; **CI**, p. 65. 1977 ≡ *Phlyctidium bumilleriae* Couch 1932; = *Rhizophydium biporosum* (Couch) D.J.S. Barr; Canad. J. Bot., **51**: 967-975. 1973
Rhizophydium capillaceum D.J.S. Barr; Canad. J. Bot., **47**: 991-997, figs. 12-22 on Pls. I-VIII. 1969. Saprophytic; pine pollen; soil; Ottawa, Ontario, Canada
Rhizophydium clavatum Karling; Sydowia, **20**: 74-84, figs. 21-24. 1967
Saprophytic; chitin bait; soil sample; N.Z.
Rhizophydium clavatum S.N. Dasgupta & R. John (homonym); Bull. Bot. Surv. India, **30**: 1-82, fig. 34. 1988. Parasitic; *Closterium*; tank; Lucknow U., India
Rhizophydium coleochaetes (Nowakowski) Fischer 1892 ≡ *Chytridium coleochaetes* Nowakowski 1876; H. Canter places in *Chytridium*; Trans. Brit. Mycol. Soc. **43**: 14-18. 1960
Rhizophydium collapsum Karling; Sydowia, **17**: 285-296, figs. 1-15. 1964
Saprophytic; pine pollen; brackish soil; Rhamnad District, India
Rhizophydium conchiforme S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 35. 1988. Saprophytic ?; *Spirogyra*; ditch; Sultanpur Road, SE of Lucknow U., India
Rhizophydium condylosum Karling; Arch. Mikrobiol., **61**: 112-127, fig. 2, A-X. 1968
Saprophytic; human hair and snake skin; soil; Cook Island, Fiji, & Pitcairn
Rhizophydium contractophilum Canter; Trans. Brit. Mycol. Soc., **42**: 185-192, figs. 1-4. 1959
Parasitic; *Eudorina elegans* and *Eudorina* sp.; Lake Windermere; E.L.D., U.K.
Rhizophydium coralloidum Karling (**IF 4**:484); Mycologia, **68**: 1245-1248, figs. 1-9. 1976
Parasitic; *Karlingia rosea*; soil; Canaveral FL, USA
Rhizophydium difficile Canter 1954 ≡ *Hapalopera difficilis* (Canter) A. Batko; **ZH**, p. 169. 1975
Rhizophydium digitatum Scherffel 1926 = *Phlyctochytrium planicorne* Atkinson 1909; see T.W. Johnson; Norw. J. Bot., **22**: 249-257. 1975
Rhizophydium dubium Kiran & Dayal (invalid; type not designated); Indian Phytopathol., **44**: 30-34, Pl. 1. 1991. Saprophytic; rotting leaves of *Eichornia*; pond; Agricultural Farm, Varanasi, India
Rhizophydium echinocystoides Sparrow; J. Elisha Mitchell Sci. Soc., **84**: 62-68, figs. 15-18. 1968. Saprophytic; pine pollen; *Sphagnum* bog; Humbolt Co, CA, USA
Rhizophydium elyensis Sparrow; Trans. Brit. Mycol. Soc., **40**: 523-535, fig 2 I-M. 1957
Saprophytic; snake skin bait; soil; Ely, Isle of Ely, U.K. (in Sparrow 1960 as footnote)
Rhizophydium ellipsoidium (Ookubo & Kobayasi) Karling; **CI**, p. 64. 1977 ≡ *Phlyctidium keratinophilum* Ookubo & Kobayasi 1955

Rhizophydium fragilariae Canter 1950 ≡ *Hapalopera fragilariae* (Canter) A. Batko; **ZH**, p. 170. 1975

Rhizophydium fugax Canter; Trans. Brit. Mycol. Soc., **51**: 699-705, Pl. 57 & fig. 1. 1968 Parasitic; *Cryptomonas* spp.; plankton of lakes; E.L.D., U.K.

Rhizophydium gonapodyanum S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 23. 1988. Parasitic; sporangium of *Gonapodya polymorpha*; tank sediment; Lucknow U., India

Rhizophydium hispidulosum Seymour; J. Elisha Mitchell Sci. Soc., **86**: 187-190. figs. 1-16. 1970. Saprophytic; cockroach wing bait; soil from ditch; Morehead City, NC, USA

Rhizophydium horizontale Paterson; Mycologia, **50**: 85-96, fig. 1 H-K. 1958 Parasitic; *Stephanodiscus* sp.; plankton, Huron River & Portage Lake; Washtenaw Co. MI, USA

Rhizophydium karlingii Sparrow 1960 = *R. laterale* (Braun) Rabenhorst; D.J.S. Barr; Canad. J. Bot., **51**: 967-975. 1973

Rhizophydium lagenaria S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 21. 1988. Parasitic; sporangium of *Blastocladia* on fruit bait; tank sediment; Lucknow U., India

Rhizophydium laterale (Braun) Rabenhorst = *R. karlingii* Sparrow 1960; D.J.S. Barr; Canad. J. Bot., **51**: 967-975. 1973

Rhizophydium lenelangeae Sparrow (**IF 4**:484); Canad. J. Bot., **55**: 1501-1504, figs. 7-15. 1977 Saprophytic; pine pollen bait; river bank soil; Guatemala

Rhizophydium littoreum Amon; Mycologia, **76**: 132-139, figs. 1-12. 1984 ?Saprophytic; *Bryopsis plumosa*; marine, Atlantic coast, USA

Rhizophydium macroporosum Karling; Sydowia, **20**: 74-84, figs. 9-20. 1967 Saprophytic; snake skin and bleached corn leaves; soil samples; N.Z.

Rhizophydium manoense Sparrow; Mycopathol. Mycol. Appl., **25**: 119-143. figs. 1-7. 1965 Parasitic; diatom (*Cocconeis*); stream; Oahu, HI, USA

Rhizophydium melosirae Friedman 1952 ≡ *Hapalopera melosirae* (Friedman) A. Batko; **ZH**, p. 170. 1975

Rhizophydium mougeotiae Pongratz; Schweiz. Z. Hydrol., **28**: 104-132, fig. 2 & Pl. 5, 33-36. 1966. Parasitic; *Mougeotia gracillima*; plankton; Lake Léman, Switzerland

Rhizophydium nobile Canter; Proc. Linn. Soc. London, **179**: 197-201, figs. 1-8. 1968 Parasitic; resting spores of *Ceratium hirundinella*; lakes; E.L.D., U.K.

Rhizophydium novae-zeylandiensis (Karling) Karling; **CI**, p. 65. 1977 ≡ *Phlyctidium marinum* Karling 1967

Rhizophydium obypriformis (Karling) Karling; **CI**, p. 64. 1977 ≡ *Phlyctidium mycetophagum* Karling 1956

Rhizophydium olla (Sparrow) Karling; **CI**, p. 65. 1977 ≡ *Phlyctidium olla* Sparrow 1933

Rhizophydium patellarium Scholz; Arch. Mikrobiol., **29**: 354-362, fig. 2. 1958 Saprophytic; pine pollen bait; soils; northern Spain and Germany

Rhizophydium pedicellatum Paterson 1956; emended by T.W. Johnson; Norw. J. Bot., **23**: 139-151. 1976

Rhizophydium pelagicum Paterson; Mycologia, **50**: 85-96, fig. 1 A-G. 1958 Parasitic; *Colacium* sp; plankton, Frains Lake; Washtenaw Co., MI, USA

Rhizophydium piriformis (Fott) Karling; **CI**, p. 65. 1977 ≡ *Hapalopera piriformis* Fott 1942

Rhizophydium planktonicum Canter 1948; emended by Canter; J. Linn. Soc., Bot., **62**: 267-278, fig. 1. 1969. Parasitic; *Asterionella formosa* (diatom); lakes; E.L.D., U.K.

Rhizophydium poculiforme S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, figs. 28-30. 1988. Parasitic; *Closterium*; tank; Lucknow U., India

Rhizophydium polystomum Karling; Sydowia, **20**: 74-84, figs. 26-29. 1967 (Pls. XII-XIV) Saprophytic; bleached corn leaves; soil samples; N.Z.

Rhizophydium porosum Sparrow & Lange; Canad. J. Bot., **55**: 1879-1890, figs. 1-5. 1977 Saprophytic; pine pollen bait; Johnson Road Bog; Cheboygan Co., MI, USA

Rhizophydium proliferum Knox & Paterson; Mycologia, **65**: 373-387, figs. 6-10. 1973 Saprophytic; pine pollen; soil or fresh water? Ross Island, Antarctica

Rhizophydium punctatum O.G. Golubeva; Novosti Sistematiki Nizshikh Rastenii, **25**: 81-86, fig. 1. 1988. Saprophytic; pine pollen; Lake Teletzkoje; Altiaca Province, Russia

Rhizophydium rarotonganensis Karling; Arch. Mikrobiol. **61**: 112-127, fig. 1 A-L. 1968 Parasitic; *Nowakowskiella profusa*; soil; Rarotonga, Cook Islands, Oceania

Rhizophydium reflexum S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 18. 1988 Parasitic; sporangium of *Blastocladia* on *Pyrus* fruit; tank sediment; Lucknow U., India

Rhizophydium rhizinum S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 17. 1988 Parasitic; sporangium of *Blastocladia* on *Pyrus* fruit; tank sediment; Lucknow U., India

Rhizophydium rotundum S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, figs. 25-27. 1988. Parasitic; *Closterium, Oedogonium*, and *Zygnema*; tank; garden, Lucknow U., India

Rhizophydium scenedesmi (Fott) Karling; **CI**, p. 65. 1977 ≡ *Phlyctidium scenedesmi* Fott 1967

Rhizophydium sibyllinum Sparrow (**IF 4**:420); Proc. Iowa Acad. Sci., **81**: 2-5, figs. 1-9. 1974 Saprophytic; pine pollen; soil; Delphi, Greece

Rhizophydium signyense Willoughby; Nova Hedwigia, **22**: 469-487, Pl. 2 m-t; 4 e, f. 1971 Saprophytic; chitin bait; soil; Signy Island, Antarctica

Rhizophydium skujai (Skuja) Karling; **CI**, p. 64. 1977 ≡ *Phlyctidium globosum* Skuja 1948

Rhizophydium sparrowii S.N. Dasgupta & R. John; Indian Phytopathol., **43**: 564-567, fig. 2. 1990 (1991). "Saproparasitic"; *Ulothrix* sp.; ditch; Sultanpur Rd, SE of Lucknow U., India

Rhizophydium sphaerocarpum var. ***rhizoclonii*** Huth & Gaertner; Trans. Brit. Mycol. Soc., **61**: 431-434, Pl. 43. 1973. Parasitic; *Rhizoclonium hieroglyphicum*; brackish water; Bremerhaven, Germany

Rhizophydium sphaerocarpum var. ***spirogyrae*** D.J.S. Barr; Canad. J. Bot., **48**: 1607-1071, figs. 1-6. 1970. Parasitic; moribund *Spirogyra*; southwestern Ontario, Canada

Rhizophydium sphaerotheca Zopf 1887
Neotype: D.J.S. Barr; Canad. J. Bot., **47**: 991-997, figs. 1-11. 1969

Rhizophydium spinosum Willoughby; Arch. Mikrobiol., **52**: 101-131, fig. 1 i-w. 1965 Saprophytic; cellophane bait; soil; Victoria, Australia

Rhizophydium spinosum Karling (homonym); Nova Hedwigia, **35**: 107-116, figs. 1-6, 1981 Saprophytic; cellophane & bleached corn leaves; soil samples; Sri Lanka

Rhizophydium spinosum S.N. Dasgupta & R. John (homonym); Bull. Bot. Surv. India, **30**: 1-82, fig. 20. 1988. Parasitic; *Blastocladia* on fruit bait; tank sediment; Lucknow U., India

Rhizophydium spinulosum (Sparrow) Karling; **CI**, p. 65. 1977 ≡ *Phlyctidium spinulosum* Sparrow 1933

Rhizophydium squamosum O.G. Golubeva; Novosti Sistematiki Nizshikh Rastenii, **25**: 81-86, fig. 2. 1988. Saprophytic; pine pollen; Lake Teletzkoje; Altiaca Province, Russia

Rhizophydium stellatum S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 22. 1988 Parasitic; Sporangium of *Gonapodya polymorpha*; tank sediment; Lucknow U., India

Rhizophydium stipitatum Sparrow; Trans. Brit. Mycol. Soc., **40**: 523-535, fig. 1 A-C. 1957 Saprophytic; snake skin bait; Cavenham Heath; Suffolk, U.K. (In Sparrow 1960 as footnote)

Rhizophydium tenue (Sparrow) Karling; **CI**, p. 65. 1977 ≡ *Phlyctidium tenue* Sparrow 1952

Rhizophydium tetragenum Pongratz; Schweiz. Z. Hydrol., **28**: 104-132, fig. 1 & Pl. 4, 25-28. 1966. Parasitic; *Asterionella formosa*; plankton; Lake Léman, Switzerland

Rhizophydium tubulatum S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 31-33. 1988. Parasitic; *Closterium*; tank; Lucknow U., India

Rhizophydium ubiquetum Canter; Trans. Brit. Mycol. Soc., **44**: 163-176, figs. I a-s, 2 a-k, Pl. 12. 1961. Saprophytic; *Cosmarium* and other desmids; plankton of lakes; E.L.D., U.K.

Rhizophydium undatum O.G. Golubeva; Novosti Sistematiki Nizshikh Rastenii, **25**: 81-86, fig. 3. 1988. Saprophytic; pine pollen; Lake Teletzkoje; Altiaca Province, Russia

Rhizophydium undulatum Sparrow & Lange; Canad. J. Bot., **55**: 1879-1890, figs. 9-11. 1977 Saprophytic; pine pollen bait; Johnson Road Bog; Cheboygan Co., MI, USA

Rhizophydium urcelolatum S.N. Dasgupta & R. John; Bull. Bot. Surv. India, **30**: 1-82, fig. 19. 1988. Parasitic; *Blastocladia* on fruit bait; tank sediment; Lucknow U., India

Rhizophydium venezuelensis Karling; Nova Hedwigia, **34**: 645-668, figs. 1-9. 1981
Saprophytic; cellophane, snake skin, hemp; soil sample; Venezuela

Rhizophydium venustum Canter; Trans. Brit. Mycol. Soc., **46**: 305-320, fig. 7, a-i. 1963
≡ *Zygorhizidium venustum* (Canter) Canter 1971
Parasitic; cysts; *Uroglena americana*; lakes; E.L.D., U.K.

Rozella Cornu 1872; D.J.S. Barr placed provisionally in Olpidiaceae [**S**]; **HP**, p. 463. 1990.
For review of *Rozella* and *Rozellopsis* see A. A. Held; Bot. Review, **47**: 451-515, 1981.

Rozella blastocladiae in S.N. Dasgupta; Indian Phytopathol. **35**: 215. 1982; ? *nomen nudum*

Rozella coleochaetis Sparrow; Pap. Michigan Acad. Sci., **50**: 115-123, figs. A-E, 1964
Parasitic; *Coleochaete* sp.; Smith's Bog; Cheboygan Co., MI

Rozella diplophlyctidis Karling; Nova Hedwigia, **45**: 529-535, figs. 1-6. 1987
Parasitic; *Diplophlyctis intestina*; moribund *Nitella flexilis*; Ross Biological Reserve

Rozella itersoniliae D.J.S. Barr & Bandoni; Mycologia, **71**: 1261-1264, figs. 1-4. 1979
Parasitic; *Itersonilia perplexante* (Hyphomycete); *Taraxacum* leaf over agar

Rozella longicollis Karling; Sydowia, **19**: 213-226, Pl. 46, figs. 21-29. 1965
Parasitic; Pythium (Oomycete); soil sample; N.Z.

Rozella longisporangia Willoughby and Rigg; Nova Hedwigia, **37**: 369-383, fig. 1 A-F. 1983
Parasitic; *Pythium* (Oomycete); field soil with neutral pH; Majorca

Rozella parva Canter; J. Linn. Soc., Bot., **62**: 267-278, fig. 3. 1969
Parasitic; *Zygorhizidium affluens*; lakes; E.L.D., U.K.

RUMINOMYCES Y.W. Ho [**N**]; Mycotaxon, **38**: 397-405. 1990 = *Anaeromyces* Breton et al. 1990 (described first)

Ruminomyces elegans Y.W. Ho; Mycotaxon, **38**: 397-405, figs. 1-3. 1990 ≡ *Anaeromyces elegans* (Y.W. Ho) Y.W. Ho 1993. Saprophytic; oat chaff; rumen, Hereford steer; Armindale, Australia

Scherffeliomyces appendiculatus (Zopf) Sparrow 1936 ≡ *Dangeardia appendiculata* (Zopf) Batko; Acta Mycol., **6**: 407-435. 1970

Scherffeliomyces leptorrhizus Johns 1956 ≡ *Dangeardiana leptorrhiza* (Johns) A. Batko; Acta Mycol., **6**: 407-435. 1970

SCHERFFELIOMYCOPSIS Geitler [**C**]; Oesterr. Bot. Z., **109**: 205-275. 1962

Scherffeliomycopsis coleochaetis Geitler; Oesterr. Bot. Z., **109**: 250-275, figs. 1-8. 1962
Parasitic ?; *Coleochaete soluta & irregula*; littoral; Lunzer Untersee, lower Austria

Septochytrium willoughbyi I.J. Dogma; Nova Hedwigia, **24**: 367-377, figs. 1-22. 1973
Saprophytic; lens paper, onion skin & cellophane; soil; virgin forest, Rondonia, Brazil

SEPTOSPERMA Whiffen ex Seymour [**C**]; Mycologia, **63**: 83-93, 1971
≡ *Septosperma* Whiffen 1942 (no Latin diagnosis)
For nomenclatural review see Blackwell & Powell; Mycotaxon **42**: 43-52. 1991

Septosperma anomalum (Couch) Whiffen ex Seymour (**IF 6**:291); Mycologia, **63**: 83-93, 1971
≡ *Septosperma anomala* (Couch) Whiffen 1942 (genus not valid when combination made)

Septosperma irregulare (Karling) I.J. Dogma (**IF 4**:318); Nova Hedwigia, **25**: 121-141. 1974
≡ *Asterophlyctis irregularis* Karling 1967

Septosperma multiforme Canter ex Milanez (**IF 3**:258); Rickia, **6**: 63-70. 1974 ≡ *Septosperma multiforma* Canter (species described before genus validated); Trans. Brit. Mycol. Soc., **46**: 305-320, figs. 4-7. 1963. Parasitic; developing cysts of algae; lakes; E.L.D., U.K.

Septosperma rhizophydii Whiffen ex R.L. Seymour; Mycologia, **63**: 83-93, 1971 ≡ *Septosperma rhizophidii* Whiffen 1942 (no Latin); Emended by W. Blackwell and M. Powell; Mycotaxon, **42**: 43-52. 1991. Also see **IF 6**:291.

Septosperma spinosum Willoughby ex Milanez; Rickia, **6**: 63-70. 1974; ≡ *Septosperma spinosa* Willoughby (species described before genus validated); Arch. Mikrobiol., **52**: 101-131, fig. 5 a-h. 1965; Parasitic; *Rhizophydium coronum*; heath; Victoria, Australia

Siphonaria variabilis Petersen 1903 emend. I.J. Dogma; Nova Hedwigia, **25**: 107-119. 1974

SOROCHYTRIACEAE Dewel [**B**]; Canad. J. Bot., **63**: 1525-1534. 1985

SOROCHYTRIUM Dewel [**B**]; Canad. J. Bot., **63**: 1525-1534. 1985

Sorochytrium milnesiophthora Dewel; Canad. J. Bot., **63**: 1525-1534, figs. 1-36. 1985
Parasitic; tardigrade (*Milnesium tardigradum*) on moss; bridge & wall; VA, USA

SPARROWIA Willoughby [**C**]; Nova Hedwigia, **5**: 335-340. 1963
Emended by I.J. Dogma; Nova Hedwigia, **19**: 503-509. 1970

Sparrowia parasitica Willoughby; Nova Hedwigia, **5**: 335-340. Pl. 52. 1963
Parasitic; oogonia of a watermold; soil; north of Thirlmere, E.L.D., U.K.

Sparrowia subcruciformis I.J. Dogma; Nova Hedwigia, **19**: 503-509, figs. 1-16. 1970
Parasitic; various chytrids; forest soil, leaf litter; Cross Village, MI, USA

Sparrowmyces in S.N. Dasgupta; Indian Phytopathol. **35**: 206. 1982; ? *nomen nudum*

Sparrowmyces sparrowii in S.N. Dasgupta; Indian Phytopathol. **35**: 206. 1982; *? nomen nudum*

Sphaerita dinobryi Canter (**IF 3**:516); J. Elisha Mitchell Sci. Soc., **84**: 56-61, fig. 1, &
Pls. 1, 2. 1968. Parasitic; *Dinobryon sertularia*; lakes; E.L.D., U.K.

SPIZELLOMYCES D.J.S. Barr [**S**]; Canad. J. Bot., **58**: 2380-2394. 1980
= *Phlyctochytrium* (in part)

Spizellomyces acuminatus (D.J.S. Barr) D.J.S. Barr; Canad. J. Bot., **62**: 1171-1201. 1984
≡ *Phlyctochytrium acuminatum* Barr 1969; = *P. africanum* Gaertner 1954

Spizellomyces dolichospermus D.J.S. Barr; Canad. J. Bot., **62**: 1171-1201, figs. 92-100. 1984
Saprophytic; pollen?; soils; widespread

Spizellomyces kniepii Gaertner ex D.J.S. Barr; Canad. J. Bot., **62**: 1171-1201. 1984
≡ *Phlyctochytrium kniepii* Gaertner 1954 (not valid)
Saprophytic; fly legs, pollen; soil; Republic of South Africa

Spizellomyces lactosolyticus D.J.S. Barr; Canad. J. Bot., **62**: 1171-1201, figs. 101-109. 1984
Saprophytic; pollen; soils; Canada

Spizellomyces palustris Gaertner ex D.J.S. Barr; Canad. J. Bot., **62**: 1171-1201. 1984
≡ *Phlyctochytrium palustre* Gaertner, 1954 (not valid)
Saprophytic; pollen; ditch, Holsburg Moor; Germany; Canada

Spizellomyces plurigibbosus (D.J.S. Barr) D.J.S. Barr; Canad. J. Bot., **62**: 1171-1201. 1984
≡ *Phlyctochytrium plurigibbosum* D. Barr 1969

Spizellomyces pseudodichotomus D.J.S. Barr; Canad. J. Bot., **62**: 1171-1201, figs. 110-120.
1984. Saprophytic; pollen; soils; Canada, U.K., and Mexico

Spizellomyces punctatus (Koch) D.J.S. Barr; Canad. J. Bot., **58**: 2380-2394. 1980
≡ *Phlyctochytrium punctatum* Koch 1957; = *Phlyctochytrium verruculosum* Knox 1970;
= *P. peruvianum* Knox 1970; D.J.S. Barr; Canad. J. Bot., **62**: 1171-1201, figs. 110-120. 1984

SPIZELLOMYCETACEAE D.J.S. Barr [**S**]; Canad. J. Bot., **58**: 2380-2394. 1980
See D.J.S. Barr (Canad. J. Bot., **62**: 1171-1201. 1984) for **key** to genera.

SPIZELLOMYCETALES D.J.S. Barr; Canad. J. Bot., **58**: 2380-2394. 1980 = Chytridiales
sensu Sparrow (in part). Emended by D.J.S. Barr; Canad. J. Bot., **61**: 295-307. 1983

Sporophlyctidium neustonicum Sparrow; Mycologia, **70**: 140-149, figs. 15-25. 1978
Parasitic; living pine pollen; neuston; Newnan's Lake, FL, USA

Synchytrium; not included, see Karling, J.S. 1964. *Synchytrium*. Academic Press, New York

TRIPARTICALCAR D.J.S. Barr [**S**]; Canad. J. Bot., **58**: 2380-2394. 1980
= *Phlyctochytrium* (in part)

Triparticalcar arcticum (D.J.S. Barr) D.J.S. Barr; Canad. J. Bot., **58**: 2380-2394. 1980
≡ *Phlyctochytrium arcticum* D.J.S. Barr 1970

Urophlyctaceae Hadar (Compt. Rend. Hebd. Séances Acad. Sci., Ser. 3, **294**: 329-333. 1982)
placed into Spizellomycetales (TEM evidence is unclear)

Zygorhizidium affluens Canter; J. Linn. Soc., Bot., **62**: 267-278, fig. 2. 1969
≡ *Rhizophydium planktonicum* Canter (in part) 1948
Parasitic; *Asterionella formosa*; plankton of lakes; E.L.D., U.K.

Zygorhizidium asterionellae Pongratz; Schweiz. Z. Hydrol., **28**: 104-132, Pl. 3, 19-24. 1966
Parasitic; *Asterionella formosa*; plankton; Lake Léman, Switzerland

Zygorhizidium chlorophycidis Canter; Nova Hedwigia, **5**: 1-6, Pls. 1, 2. 1963
Parasitic; colonial planktonic greens; lakes; E.L.D., U.K.

Zygorhizidium cystogenum Canter; Trans. Brit. Mycol. Soc., **46**: 305-320, figs. 1, 2. 1963
Parasitic; *Dinobryon* spp., *Uroglena* sp.; lakes; E.L.D., U.K.
Zygorhizidium melosirae Canter 1950; Canter emended; J. Linn. Soc., Bot. **60**: 85-96. 1967
Zygorhizidium planktonicum forma ***asterionellae*** Canter, Jaworski, & Beakes; Nova Hedwigia, **55**: 437-455. 1992. Parasitic; *Asterionella*; lakes; E.L.D., U.K.
Zygorhizidium planktonicum forma ***synedrae*** Canter; Nova Hedwigia, **55**: 437-455. 1992.
Parasitic; *Synedra*; lakes, E.L.D., U.K.
Zygorhizidium vaucheriae Rieth; Biol. Zentralbl., **86**: 433-448, figs. 1, 2, Pls. 1, 2. 1967
Parasitic; *Vaucheria*; ditch; Gatersleben, Germany & Tadzhik S.S.R.
Zygorhizidium venustum (Canter) Canter; Nova Hedwigia, **21**: 577-592. 1971
≡ *Rhizophydium venustum* Canter 1963

MYCOTAXON

Volume LX, pp. 175-180 October-December 1996

COCCOIDELLA EXOCARPI SP. NOV. ON *EXOCARPOS* SPP. FROM AUSTRALIA

Z. Q. Yuan[1,2], C. Mohammed[1,2] and T. J. Wardlaw[3]

[1] Dept. of Agric. Science, University of Tasmania, GPO Box 252C Hobart,
Tasmania, Australia, 7001
[2] CSIRO, Div. of Forestry, Tasmanian Research Centre, Locked Bag No 2, Sandy
Bay Post Office, Sandy Bay, Tasmania, Australia, 7005
[3] Forestry Commission, 199 Macquarie St. Hobart, Tasmania Australia, 7000

SUMMARY

Coccoidella exocarpi Z.Q. Yuan sp. nov., on living twigs of *Exocarpos* spp. is described and illustrated. The differences between the new species and the known species of the genus are discussed and the measurements of the main characteristics of all the known species are given in a summary table. Differences between *Coccoidella* and *Microcyclus* are briefly discussed.

Exocarpos Labill is a small genus in Santalaceae containing about 20 species distributed across the countries of Australia, Malaysia, Polynesia, New Zealand and Madagascar. They are almost always parasitic on the roots of other plants (Curtis 1967). *E. cupressiformis* Labill, commonly known as the "native cherry" in Tasmania, is an indigenous species common throughout the more open eucalypt forests of Tasmania and other temperate Australian regions (Curtis 1967). Little is known about the fungi which occur on this tree genus. The only fungi recorded to date on members of this genus are *Marasmius exocarpi* Berk. and *Meliola exocarpi* H. S. Yates, both on *E. latifolius* R. Br. (Saccardo 1887; Saccardo & Trotter 1926). In addition, two lichens, *Hypogymnia subphysodes* (Krempelh.) Filson var. *austerodioides* Elix (*Brunonia* **2**, 230, 1979) and *Menegazzia confusa* P.W. James (*Lichenologist* **19**, 26, 1987) have been recorded on the bark of *E. cupressiformis* from South Australia.

An ascomyceteous fungus appears to be common on *E. cupressiformis* in Tasmania. Morphological examination shows that it is a member of the genus *Coccoidella* Höhnel. *Coccoidella*, syn. *Coccodothella* Theiss. et Syd., was established by Höhnel (*Sitzb. Akad. Wien* **118**, 847,1909), based on *C. scutula*

(Berk. et Curt.) Höhnel and currently includes eight species (Müller & Arx 1962; Bose & Müller 1964; Sivanesan 1987). Species of the genus have superficial disc-like or crustose stromata, which usually contain a few, fasciculate asci in locules, and taper to a central hypostromatic foot immersed in host tissue. Ascospores are ellipsoid or fusoid, hyaline to brown, usually with one median septum, but sometimes 3-septate. The Australian National Collection of Fungi (NCOF) database was checked for other fungal collections on *Exocarpos*. Three collections referred to as *Microcyclus* sp., all on *E. stictus* R.Br. were found in the Herbarium, Institute for Horticultural Development Victoria (VPRI 17831b, 17832a, 17834a). Examination of these collections in VPRI show they were identical, particularly as regards ascospore morphology, to the collections on *E. cupressiformis*. As this fungus has the typical characteristics of the genus *Coccoidella* mentioned above, and is not conspecific to any known species, it is proposed here as a new species. The holotype is deposited in the Herbarium, Department of Primary Industries, Queensland (BRIP).

Coccoidella exocarpi sp. nov. Z.Q. Yuan Fig. 1, a-d

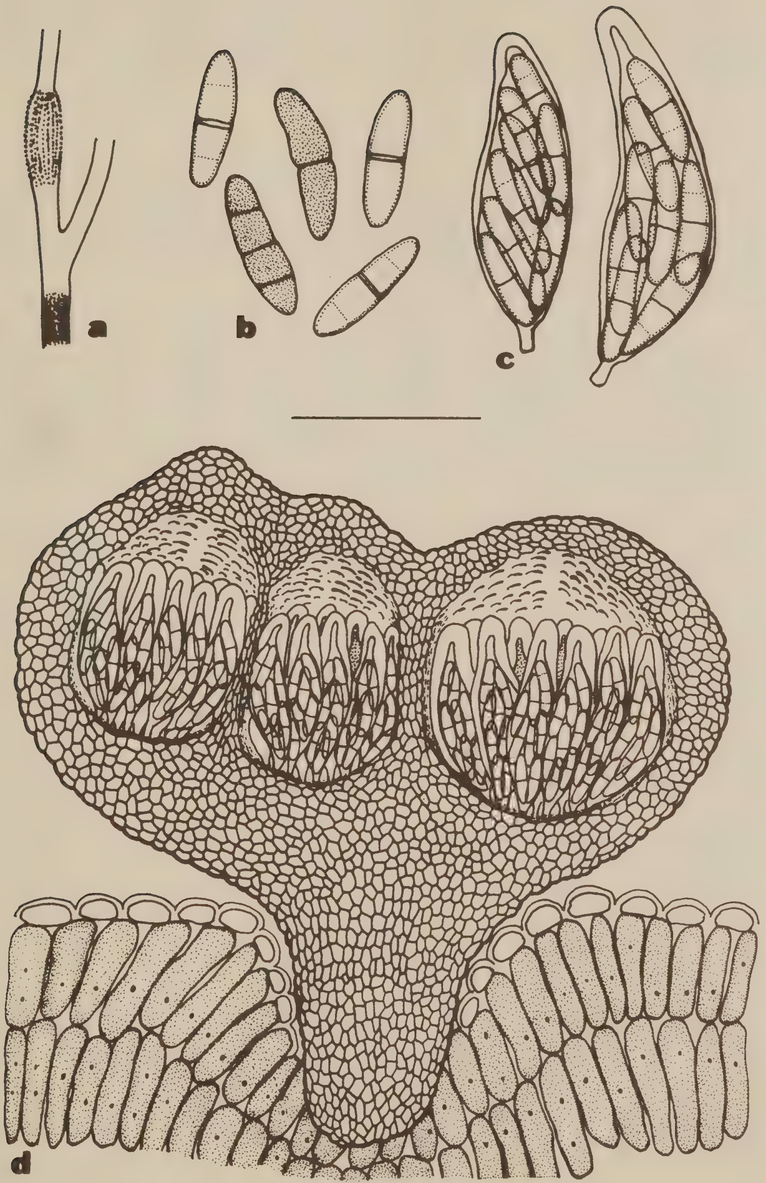
Stromata caulicola, gregaria, superficialia, cum basibus immersis, rotunda vel pulvinata, 250-500 µm lata, 150-250 µm alta, 2-5 (vulge 3) ascomata continentia. Textum stromatis pseudoparenchymatum, e cellulis atrobrunneis, crassitunicatis, angularibus ad subsphaericis (5-9 µm diam.) et basi cellulis elongatis compositum. Loculi ascomati sphaerici vel subsphaerici, 100-125 µm lati, 90-100 µm alti. Paries loculi 20-40 µm crassus, e cellulis crassitunicatis, elongatis (7-12 x 2.5-5 µm), in 4-5 stratis disposidis compositus. Asci 90-100 x 18-25 µm, bitunicati, obclavati vel ovoidei, ad basim latiores transeuntes, stipitati, octospori. Pseudoparaphyses absentes. Ascosporae 25-38 x 7-9 µm, superimposite bi- vel multiseriatae, ellipsoideae ad fusoideae cum extremio rotundato, rectae vel leviter curvatae, 1-3-septatae, non- vel raro constrictae ad septum medium, hyalinae ad pallide brunneae vel brunneae ad maturitatem.

Holotypus in ramulis (foliis) vividis *Exocarpi cupressiformis* Labill, Hobart, Tasmania, Australia, V. 1995, T. Wardlaw, C. Mohammed & Z.Q. Yuan, BRIP 22785.

Stromata caulicolous, longitudinally aggregated along stems with bases immersed in the host tissue, usually circular or pulvinate, 250-500 µm wide and 150-250 µm high, containing 2-5 (mostly 3) ascomata. Stromatal tissue composed of thick-walled dark brown, angular to subspherical pseudoparenchymatous cells measuring 5-9 µm diam. and elongated at the base of stromata. Ascomatal locules spherical or subspherical, 100-125 µm wide and 90-100 µm high, wall 20-40 µm in thickness, composed of 4-5 layers of thick-walled, elongated cells (7-12 x 2.5-5µm). Asci 90-100 x 18-25 µm (mean = 94 x 22 µm, n = 50), bitunicate, obclavate to ovoid, tending wider toward the base, abruptly short-stipitate, measuring 7-9 x 3-4 µm, 8-spored. Pseudoparaphyses absent. Ascospores 25-38 x

---

Fig. 1. *Coccoidella exocarpi*: a. habit, b. ascospores, c. asci, d. stromata in vertical section. (standard line = 40 µm for b and c; 100 µm for d; habit sketch not scale)


a
b
c
d

7-9 µm (mean = 30 x 7.8 µm, n = 50), overlapping bi- to multiseriate, ellipsoid to fusoid with rounded ends, sometimes slightly narrower toward lower parts, straight or slightly curved, 1-septate, not or slightly constricted at the middle septum, hyaline to pale brown, guttulate when young, becoming 3-septate and brown at maturity.

On living twigs (scaled leaves) of *Exocarpos* spp.

SPECIMENS EXAMINED Australia: Hobart, Tasmania, *Exocarpos cupressiformis*, May 1995 T. Wardlaw, C. Mohammed & Z.Q. Yuan (Holotype BRIP 22785); Wonboyn, New South Wales, *E. strictus*, 26 March 1992, I. Pascoe (VPRI 17831b, VPRI 17832a, VPRI 17834a).

Measurements of the main characteristics of all the known species of *Coccoidella* are compared in Table 1. Of all the *Coccoidella* species known (Müller & Arx 1962; Bose & Müller 1964; Sivanesan 1987), this fungus is closest to *C. perseae* A. Sivanesan in ascospore morphology, but differs in having smaller stromata and much wider asci and ascospores (Table 1). The asci in *C. perseae* are cylindric-clavate (Sivanesan 1987), rather than obclavate to ovoid as in this fungus.

Coccoidella is morphologically close to *Microcyclus* and differs from the latter genus mainly in the type of stromata and in the number of septa and pigmentation of the ascospores. Stromata are erumpent from substrate in *Microcyclus* and superficial with free hyphae in *Coccoidella* (Barr, 1987). Based on early reports (Clements & Shear 1931; Luttrell 1973; Wehmeyer 1975) the ascospores in both genera are 2-celled, but hyaline in *Microcyclus* and yellowish to pale brown or yellow brown in *Coccoidella*. Sivanesan (1987) described one *Coccoidella* species with 1-3-septate, pigmented ascospores. In terms of pseudoparaphyses, Clements & Shear (1931), Luttrell (1973) and Wehmeyer (1975) considered that *Microcyclus* has pseudoparaphyses and *Coccoidella* lacks them. Sivanesan (1984) mentioned that *Microcyclus* has filiform, hyaline pseudoparaphysoids, usually disappearing in mature stromata. Müller & Sanwal (1954) noticed remnants of paraphysoid tissue or interthecial tissues in *Microcyclus*, and Barr found such remnants in specimens of both *M. tinctorius* (Tul.) von Arx and *C. scutula*, and included both genera in the Dothideaceae (Barr 1987). Based mainly on the characteristics of stroma, ascospore septum and colour, the present fungus on *Exocarpos* is best included in the genus *Coccoidella*. In addition, the genus *Microcyclus* is tropical and subtropical (Cannon *et al*. 1995) and the ostioles are schizogenous and lined with short periphyses (Barr 1995, pers. comm.). In the collections of VPRI named *Microcyclus* sp., we found superficial stromata and four-celled, pigmented ascospores which are identical to those in our collections. We therefore assign those collections to the genus *Coccoidella* along with our collections in the present study.

Table 1: Measurement of main characteristics of *Coccoidella exocarpi* and the known species of *Coccoidella**

Species	Ascostroma Width x Hight (µm)	Locule diam. (µm)	Ascus Length x Width (µm)	Ascospore Length x Width (µm)	Septum of ascospore (No.)
[4]*C. exocarpi* Z.Q. Yuan	250-500 x 150-250	90-125	90-100 x 18-25	25-38 x 7.0-9.0	1-3
[2]*C. euglypta* (Mont.) E. Müll. et Sanwal	600-1000 x 200-250	150-200	100-130 x 12-15	14-17 x 5.0-6.0	
[2]*C. fici* (Henn.) Theiss. et Syd.		60-110	50-70 x 14-18	18-30 x 5.0-7.0	1
[2]*C. fusispora* Petr. et Cif.				24-35 x 6.0-7.5	
[3]*C. perseae* Sivan.	770-1200 x 220-330	225	75-90 x 12-13.5	30-31 x 4.0-4.5	1-3
[2]*C. pulvinata* Petr. et Cif.	500-2000 x 200-400	60-110	42-60 x 16-20.0	16-23 x 6.5-8.0	
[1]*C. quercifolia* S.K. Bose & E. Müll.	140-250 x 60-75	70-90	45-55 x 10-12.0	14-16 x 4.0-5.0	1
[2]*C. scutula* (Berk. et M.A. Curtis) Höhn.	600-800	60-80	50-70 x 16-18.0	18-23 x 4.0-6.0	
[2]*C. stevensonia* (Cif. et Bat.) E. Müll.	250-1000 x 250-500		55-60 x 14-20.0	19-29 x 5.5-8.0	

*Based on [1]Bose & Müller (1964), [2]Müller & Arx (1962), [3]Sivanesan (1987) and [4]the present study.

Acknowledgments

The authors are much obliged to Dr. M.E. Barr (Sidney, Canada) for reviewing the manuscript and to Dr. I. Pascoe of VPRI for loan of materials. The senior author also wish to thank the University of Tasmania and CSIRO, Division of Forestry for scholarships.

References

Barr, M.E. 1987. *Prodromus to class Loculoascomycetes*. Publ. by the author, Amherst, Massachusetts.

Bose, S.K. and E. Müller. 1964. Central Himalayan fungi - 1. *Indian Phytopathol.* **17**, 3-22.

Cannon, P.F., C.C. Carmaran and A.I. Romero. 1995. Studies on biotrophic fungi from Argentina: *Microcyclus porlieriae*, with a key to South American species of *Microcyclus*. *Mycol. Res.* **99**, 353-350.

Clements, F.E. and C.L. Shear. 1931. *The genera of fungi*. Hafner Publ. Co. New York.

Curtis, W.M. 1967. *The student's flora of Tasmania, Part 3: Angiosperme: Plumbaginaceae to Salicaceae*. Government Printer, Tasmania.

Luttrell, E.S. 1973. Loculoascomycetes. In *The Fungi* **IVA** (ed. G.C. Ainsworth, F.K. Sparrow & A.S. Sussman), pp. 135-219. New York and London: Academic Press.

Müller, E. and J.A. von Arx. 1962. Die Gattungen der didymosporen Pyrenomyceten. *Beitr. Kryptogamenfl. Schweiz* **11**, 1-922.

Müller, E. and B.D. Sanwal. 1954. Über die Gattungen *Microcyclus* Sacc., *Coccoidella* v. Höhn., *Coccodothis* Theiss. et Syd. und *Coccodothella* Theiss. et Syd.. *Sydowia* **8**, 231-244.

Saccardo, P.A. 1887. Agaricineae, Leucosporae, *Marasmius*. *Sylloge Fungorum* **5**, 503-569.

Saccardo, P.A. and A. Trotter. 1926. Pyrenomycetae, Perisporiaceae, *Meliola*. *Sylloge Fungorum* **24**, 263-358.

Sivanesan, A. 1984. *The bitunicate ascomycetes and their anamorphs*. J. Cramer, Vaduz.

Sivanesan, A. 1987. *Coccoidella perseae* sp. nov. and its anamorph *Colletogloeum perseae* sp. nov.. *Trans. Brit. Mycol. Soc.* **89**, 265-270.

Wehmeyer, L.E. 1975. The Pyrenomycetous fungi. *Mycologia Memoir* **6**, 1-248.

MYCOTAXON

Volume LX, pp. 181-190 October-December 1996

NEW AND INTERESTING WOOD-INHABITING FUNGI (BASIDIOMYCOTINA - APHYLLOPHORALES) FROM ETHIOPIA

Kurt Hjortstam
Målaregatan 12, S-441 35 Alingsås, Sweden

Leif Ryvarden
Univ. of Oslo, Division of Botany, P. O. Box 1045, N-0316
Oslo, Norway

ABSTRACT

15 species of Corticiaceae s.l. are reported as new to Ethiopia: *Diplomitoporus rimosus* (Murrill) Gilb. & Ryvarden and *Physisporinus rivulosus* (Berk. & M.A. Curtis) Ryvarden as new to Africa. *Mycoacia brunneofusca* Hjortstam & Ryvarden and *Vuilleminia obducens* Hjortstam & Ryvarden are described as new. Keys are offered to tropical species of *Mycoacia* and *Vuilleminia*.

Keywords: Aphyllophorales, Corticioid fungi, Ethiopia

INTRODUCTION

Ethiopia`s wood-inhabiting fungi are poorly known. Bresadola (1896) was the first to report wood-inhabiting fungi from the country, concentrating almost exclusively on polypores. Scattered observations were published by Hennings (1893, 1901, 1904 and 1905). More recently many species of polypores were reported as new for Ethiopia by Ryvarden & Johansen (1980), while a number of corticioid species were reported as new from the country by Hjortstam (1983 and 1987). G. Langer (1994) described *Tofispora repetospora* G. Langer & Ryvarden based on an Ethiopian collection and recently Boidin & Lanquetin (1995) reported 16 corticioid species as well as describing three new species.

In July 1990, one of us (LR) had the opportunity to collect in the central and southern part of Ethiopia a total of 700 specimens of wood-inhabiting fungi were obtained. Some agarics and ascomycetes were sent to the Royal Botanic Gardens, Kew, while some of the more interesting wood-inhabiting corticioid and poroid species are reported here.

The following localities were visited:

Shoa province, Chilimo, Ginchi, 2400 m, 10 July, Ryv. 28046-28139.
Shoa province, Mena Gesha Nat. Park. 2400 m, 12-14 July, Ryv. 28140-28308, 28677-28743.
Arussi province, Munessa forest, Lake Langano, 2100m, 15 July, Ryv. 28309-28433.
Arussi province, Wondo Genet, 16-19 July, 2100m, Ryv. 28434-28676.

From the collection number, it is easy to find the exact locality for each species.

CORTICIOID FUNGI

Athelopsis glaucina (Bres.) Hjortstam
A rather well known fungus on ferns, see Hjortstam (1991) and Hjortstam and Larsson (1994).
Specimen: Ryv. 28089.

Dextrinodontia molliuscula Hjortstam & Ryvarden
Previously known from Tanzania and Kenya.
Specimens: Ryv. 28296/b, 28342 and 28466.

Gloiothele lamellosa (Henn.) Bres.
This species was originally described from Tanzania and seems to be restricted to Africa. Specimens have been seen from Malawi and it was also described as *Vesiculomyces epitheloides* Boidin et al. (Boidin and Lanquetin, 1983) from Madagascar. See also Hjortstam (1987) who re-introduced the generic name *Gloiothele* Bres.
Specimen: Ryv. No. 28356.

Hyphodontia spathulata (Schrad.:Fr.) Parmasto
Rather well known and possibly a cosmopolitan species, but previously not reported from Africa (except the Canary Islands, see Rodriques-Armas et al. (1992). It is known from Europe, North and South America and was reported from India by Rattan (1977) and recently from Taiwan by E. Lang-

er (1994). It seems to be most common in North America and in the central part of Europe. There is a description with a superb drawing in Eriksson and Ryvarden (1976). It should be noted that the torulose gloeocystidia are not always present, or are rather difficult to find.
Specimen: Ryv. No. 28152/C.

Kavinia alboviridis (Morgan) Gilb. & Budington
A widespread species in the Northern hemisphere and additionally known from Argentina and India (Hjortstam and Larsson, 1994). Recently also recorded from Brazil (Laessoe No. 52600).
Specimen: on dead deciduous wood Ryv. 28316.

Litschauerella clematitis (Bourdot & Galzin) J. Erikss. & Ryvarden
The micromorphology of this species is not sufficiently well known.
The two specimens from Ethiopia are similar but No. 28211 has warted spores (KOH) measuring 7-8 x 7.5-9 µm while No. 28303 has slightly smaller, smooth spores (KOH). *Litschauerella gladiola* (G. Cunn.) Stalpers & Buchanan (see Stalpers and Buchanan, 1991) is extremely similar except for its smooth spores and small asterocystidia. The latter elements were, however, demonstrated by Boidin and Gilles (1986) in a specimen from Réunion under the name *L. abietis* (Bourdot & Galzin) Oberw.
Specimens: on *Juniperus procera*, Ryv. Nos. 28211 and 28303.

Melzericium udicola (Bourdot) Hauerslev
Previously known from Europe, North America, South America (Argentina) and the Canary Islands.
Specimen: on dead hardwood, Ryv. No. 28334.

Mycoacia brunneofusca Hjortstam & Ryvarden nov. sp.
Species habitu cum Mycoacia fuscoatra , sed differt cystidiis nullis et sporis ellipsoideis 4-4.5(-4.8) x 2.2-2.5(-2.8)µm

Holotypus: Africa, Ethiopia, Shoa Prov. Chilomo Forest, Ginchu 2400 m, 10 July 1990, on dead wood, Ryv. No. 28105 (O). Isotypus: (K).
Paratypi: Africa, Ethiopia , Shoa Prov. Mena Gesha nat. park 2400-2600m, 12 July 1990, on dead hardwood, Ryv. Nos. 28156 and 28264 (O).

BASIDIOME resupinate, closely adnate, forming irregular areas 10-15 x 3-5 cm or sometimes larger.
HYMENOPHORE strongly hydnoid and becoming irregularly creviced, at first light brown, then darkening to more or less blackish brown.
ACULEI densely crowded, conical, smooth, about 1-1.5 mm long, concolorous with the subiculum, or sometimes with a greyish-white tip.

SUBICULUM thin to 0.5-1 mm thick, brown to blackish.
HYPHAL SYSTEM monomitic; hyphae mostly agglutinated, hyaline to pale brown and more or less parallely arranged in the centre of the aculei and forming a thin trama, apically often strongly encrusted, thin-walled to more commonly thick-walled, 2.5-3.5µm wide. All hyphae with clamp-connexions.
CYSTIDIA absent.
BASIDIA narrowly clavate, (15-)18-20(-25)µm long, with four sterigmata and a basal clamp-connexion.
SPORES hyaline, ellipsoid, thin-walled, smooth, 4-4.5(-4.8) x 2.2-2.5(-2.8)µm, non-amyloid.

REMARKS. The basidiomes of this species are strongly reminiscent of *Mycoacia fuscoatra* (Fr.:Fr.) Donk which, however, has larger, sub-cylindrical spores measuring 5-6 x 2.5µm and distinct subulate cystidia.

KEY TO TROPICAL AND SUBTROPICAL SPECIES OF MYCOACIA

For *Mycoacia*-like basidiomes without clamp-connexions, see in the first case *Columnodontia* and also some species of *Phanerochaete* and *Phlebia.*

1. With strongly encrusted cystidia (metuloids). Canary Islands, Thailand, Australia and New Zealand......................**nothofagi** (G. Cunn.) Ryvarden
1. Cystidia otherwise shaped or absent..**2**
2. Cystidia present **3**
2. Cystidia absent, but in some species with strongly encrusted hyphae in the apical part of the aculei..**5**
3. Cystidia subulate to acicular, spores 5-6 x 2-2.5 µm. Canary Islands and India..**fuscoatra** (Fr.:Fr.) Donk
3. Cystidia subfusiform ± obtuse..**4**
4. Cystidia up to 30 µm long, non-septate, spores 5-6 x 2-2.5 µm, Canary Islands, Morocco, Ethiopia. *Mycoacia subceracea* (Wakef.) G. Cunn. is extremely similar or a synonym.......................................**uda** (Fr.) Donk
4. Cystidia (or hyphal ends) septate (with clamp-connexions), projecting to 90 µm above the basidia, spores 5-6 x 2.5-3 µm (Cunningham 1959). New Zealand..**lutea** (G. Cunn.) Hjortstam
5. Aculei with strongly encrusted and projecting hyphal ends.....................**6**
5. Encrusted hyphae not prominent or absent...**8**
6. Spores ellipsoid, 4.5-6 x 2.5-3 µm. New Zealand. ....**columellifera** (G. Cunn.) Jülich
6. Spores narrowly ellipsoid to suballantoid..**7**
7. Spores narrowly ellipsoid, 5-6 x 2-2.5 µm................................**fuscoatra**

7. Spores 4-4.5 x 1.8-2 µm. Australia, New Zealand (Ecuador?) ....**subfascicularia** (Wakef.) Hjortstam
8. Spores suballantoid to allantoid...**9**
8. Spores ellipsoid...**10**
9. Spores allantoid, 4-4.5 x 1-1.25 µm. Brazil ....**subconspersa** (Rick ex Rambo) Hjortstam & Ryvarden
9. Spores (sub)allantoid, 3.5-5.5 x 1.5-2 µm. Canary Islands, Africa and India..**aurea** (Fr.) J. Eriksson
10. Basidiome light brown to blackish brown, teeth conical, spores 4-4.8 x 2.2-2.8 µm. Ethiopia......................**brunneofusca** Hjortstam & Ryvarden
10. Basidiome pale buff to cream, teeth cylindrical, spores 4-4.5 x 2-2.5 µm (Gilbertson et al. 1976). USA (Arizona)..........**austro-occidentalis** Canf.

Phanerochaete rosea (Henn.) P. K. Buchanan & Hood
This is a well known species, at least in eastern Africa, and has been previously reported by Hjortstam and Ryvarden (1980) from Tanzania and Kenya. It also seems to be distributed in the southern part of Africa and has been recently reported from New Zealand by Buchanan and Hood (1992).
The micromorphology conforms with the generic concept of *Phanerochaete*, above all by the absence of clamp-connexions and the morphology of the basidia and hyphae. For a modern description with figure see Hjortstam and Ryvarden (1980).
Specimen: Ethiopia, Shoa Prov. Wondo Genet Forestry College, near Shashemene 1800 m, 18 July 1990, on dead hardwood, Ryv. No. 28487.

Phlebiella ardosiaca (Bourdot & Galzin) K.H. Larss. & Hjortstam
A little known fungus, mainly distributed in central and southern Europe The species is further known from the Canary Islands (Rodriques-Armas et al. 1992) and has been collected by Ryvarden from Malawi.
Specimen: Ethiopia, Shoa Prov. Mena Gesha nat. park. 2400-2600 m , 12 July 1990, on *Juniperus procera*, Ryv. No. 28187.

Repetobasidiellum fusisporum J.Erikss.& Hjortstam
Previously known from Sweden and Brazil, this is an obligate fungus on different kinds of ferns (in South America collected on *Cyathea* sp. and *Dicksonia* sp.). It grows on remnants still attached to the plant and is often found together with *Athelopsis lembospora* (Bourdot) Oberw. The material from Ethiopia is poorly developed, or rather too dry, but some typical spores and a few dendrohyphidia have been observed. As the fungus was insufficiently known when described, we offer a more detailed description based on specimens from Brazil. A good drawing was made by John Eriksson (in Eriksson, Hjortstam and Ryvarden, 1981), and it should also be

noted that the species was neotypified by Hjortstam (1987).
BASIDIOME resupinate, closely adnate, thin to moderately thick, at first pruinose and discontinuous, then continuous and ceraceous, whitish to more commonly grey and especially when old more or less glossy.
HYPHAL SYSTEM monomitic; hyphae with clamp-connexions, 1.5-2.5(-3)μm wide, often strongly agglutinated and forming a very dense tissue. In some specimens clamp-connexions are difficult to discern without making a thin, vertical section of the fungus.
CYSTIDIA absent.
DENDROHYPHIDIA present in most cases and easily observed, distinctly ramified and protruding as much as 10μm above the basidia, thin-walled, widened in the basal part and often strongly encrusted.
BASIDIA at first subglobose, then subcylindrical to slightly urniform, mostly constricted in the middle part, 20-30 x (6-)7-8μm, with four sterigmata and a basal clamp-connexion, the repetition (mentioned in the original description) as well as clamp-connexions are difficult to observe except in fresh material in either Melzer´s reagent or Cotton blue.
SPORES mostly sublunate to subfusiform, (6.5-)8-12 x 2.5-3.5μm (in the original description 6.5-8 x 2.5-3μm), thin-walled, smooth, non-amyloid, non-dextrinoid and cyanophilous.
Specimen: on *Adianthum* sp. Ryv. No. 28468.

Scytinostromella heterogenea (Bourdot & Galzin) Parmasto
This species is mainly distributed in the Northern Hemisphere (Eriksson, Hjortstam and Ryvarden, 1984) and is also known from Morocco (Malençon, 1982) and India (Rattan, 1977).
Specimen: Ryv. No. 28296.

Sistotrema subtrigonospermum D.P. Rogers.
Specimen: Ryv. No. 28048.

Vuilleminia obducens Hjortstam & Ryvarden nov. sp.
Differt a Vuilleminia comedens sporis subglobosis, 9-12(-14) x 7-8(-9)μm.

Holotypus: Africa, Ethiopia, Shoa Prov. Chilomo Forest, Ginchu 2400 m, 10 July 1990, Ryv. No. 28131 (O). Isotype: (GB, K). Paratype: Ryv. No. 10568 (K).

BASIDIOME resupinate, effused, 0.2-0.3 mm thick, closely adnate but loosening at the margin.
HYMENOPHORE smooth to slightly tuberculate, pale brown with a somewhat violet tint, margin indeterminable or more commonly darker than the fertile part.

HYPHAL SYSTEM monomitic; all hyphae with clamp-connexions, generative hyphae thin-walled, other hyphae thin-to moderately thick-walled, hyaline, often encrusted, 3.5-4µm wide, basal hyphae agglutinated and usually very pale yellowish, otherwise similar and forming a thin, 0.1-0.2 mm deep, pale brown and rather hard subiculum.

DENDROHYPHIDIA indistinctly developed, encrusted.

CYSTIDIA few, tubular and often apically subcapitate, thin-walled or apically slightly thick-walled, 60-80 (-100)µm.

BASIDIA tubular-clavate, somewhat sinuous, 60-70(-80)µm long and about 10µm wide in the upper part, with four, rather stout sterigmata and a basal clamp-connexion.

SPORES subglobose, smooth, thin-walled, 10-12(-14) x 7-8(-9)µm, non-amyloid, non-dextrinoid and cyanophilous.

REMARKS. In outward appearance very similar to some species of *Peniophora*, e.g. *P. quercina* (Pers.:Fr.) Cooke, but immediately separated from this genus under the microscope. It possibly has the same ability as *Vuilleminia comedens* (Nees:Fr) Maire to break through the bark or at least loosen characteristically at the margin. The species should be easily recognised by its large basidia and by being the only species in *Vuilleminia* so far with ellipsoid spores.

KEY TO TROPICAL AND SUBTROPICAL SPECIES OF VUILLEMINIA

1. Cystidia present...2
1. Cystidia absent..4
2. Cystidia subulate, spores allantoid, 15-20 x 4.5-6 µm. Canary Islands. ....**cystidiata** Parm.
2. Cystidia capitate...3
3. Cystidia few, tubular, apically subcapitate, spores globose 10-14 x 7-9 µm. Ethiopia.......................................**obducens** Hjortstam & Ryvarden
3. Cystidia distinctly capitate, spores allantoid 15-20 x 5-6 µm. Morocco. ....**macrospora** (Bres.) Hjortstam
4. Spores globose to subglobose...5
4. Spores allantoid or ellipsoid...6
5. Spores 14-18 x 9-13 µm. Argentina. ....**subglobispora** Hallenb. & Hjortstam
5. Spores 10-14 x 7-9 µm...**obducens**
6. Spores allantoid 15-25 x 5-6 µm. Ecuador ?, Morocco, Tunisia, New Zealand ?...**comedens** (Nees:Fr.) Maire
6. Spores ellipsoid 20-28 x 9.5-13 µm (Boidin et al. 1994). Cameroon ? ....**megalospora** Bres.

Xenasma pruinosum (Pat.) Donk
A well known though rare species, though rare, from the Northern Hemisphere, originally described from Tunisia. For further information on its tropical distribution see Hjortstam and Larsson (1994).
Specimens: Ryv. Nos. 28126 and 28341.

Xenasma pulverulentum (Litsch.) Donk
Distributed mainly in the Northern Hemisphere and originally described from Austria. Also known from Venezuela (Liberta and Navas, 1978), Colombia and Argentina (Gomez, 1973) and Reunion (Boidin and Gilles, 1989) and reported from Morocco by Malençon (1982).
Specimen: on *Juniperus procera,* Ryv. No. 28297.

Xenasma rimicolum (Karst.) Donk.
Also reported by Boidin & Lanquetin (1995).
Specimen: Ryv. 28068.

POROID FUNGI

Diplomitoporus rimosus (Murrill) Gilb. & Ryvarden
New to Africa. The species is only known from *Juniperus,* as indicated in Gilbertson & Ryvarden (1986), where a detailed description is given. The distinct characters are the cracking of the pore surface, hence the name, the tubular cystidia and the host. It adds to the group of species restricted to *Juniperus* such as *Pyrofomes demidoffii* and *Antrodia juniperina* both known from this host in Africa (including Ethiopia), Europe and America. *D. rimosus* has not as yet been found in Europe, but it is very probable that it will be found, taking the distribution of the two other species into account.
Specimen: on *Juniperus procera*, Ryv. 28227.

Physisporinus rivulosus (Berk. & M.A. Curtis) Ryvarden
New to Africa. The species is widespread in America and rare in Europe.
Specimen: on dead hardwood, Ryv. 28444,

LITERATURE CITED

Boidin, J. and Gilles, G. 1986. Basidiomycetes Aphyllophorales de l'ile de la Réunion. II. Les genres *Tubulicrinis*, *Tubulicium* et *Litschauerella*. Bull. Soc. Mycol. Fr. 102:279-290.

—**1989.** Basidiomycetes Aphyllophorales de l'ile de la Réunion. XIII et XIV. Bull. Soc. Mycol. Fr. 105:130-150.

Boidin, J. and Lanquetin, P. 1983. Basidiomycetes Aphyllophorales Epitheloides Etales. Mycotaxon 16:461-499.

—1995. Sur quelques Corticies (Basidiomycotina) de l`Ethiopie. Crypt. Mykol. 16:79-84.

Boidin, J., Lanquetin, P. and Gilles, G. 1994. Contribution à la connaissance du genre *Vuilleminia* (Basidiomycotina) Bull. Soc. Mycol. Fr. 110:91-107.

Bresadola, G. 1896. Contribuzioni alla conoscenza della flora dell`Africa Orientale. Ann. Royal. Inst. Bot. It. Roma 6:177-180.

Buchanan, P.K. and Hood, I.A. 1992. New species and new records of Aphyllophorales (Basidiomycetes) from New Zealand. N. Z. Jl Bot. 30:95-112.

Cunningham, G.H. 1959. Hydnaceae of New Zealand. Part. II-The Genus *Odontia*. Trans. Roy. Soc. New Zealand 86:65-103

Eriksson, J., Hjortstam, K. and Ryvarden, L. 1981. The Corticiaceae of North Europe Vol.6. *Phlebia-Sarcodontia*. Fungiflora, Oslo, Norway.

—1984. The Corticiaceae of North Europe Vol. 7. *Schizopora - Suillosporium*. Fungiflora, Oslo, Norway.

Eriksson, J. and Ryvarden, L. 1976. The Corticiaceae of North Europe. Vol. 4. *Hyphodermella - Mycoacia.* Fungiflora, Oslo, Norway.

Gilbertson, R.L., Burdsall, H.H. and Canfield, E.R. 1976. Fungi that decay mesquite in southern Arizona. Mycotaxon 3:487-551.

Gilbertson, R. L. and Ryvarden, L.1986. North American Polypores. *Abortiporus - Lindtneria*. Fungiflora, Oslo, Norway.

Goméz, C.E. 1973. *Xenasma* y generos afinis de los Alrededores de Buenos Aires (Aphyllophorales). Bol.Soc.Arg.Bot.14:269-281.

Hennings, P. 1893. Fungi Aethiopici Arabici. Bull. herb. Boissier 1:97-122.

—1901. Fungi Africae orientalis I. Engler Bot. Jahrb. 28:318-329.

—1904. Id. III. Engler Bot. Jahrb. 34:39-57.

—1905. Id. IV Engler Bot. Jahrb. 38:102-118.

Hjortstam, K. 1983. Studies in tropical Corticiaceae (Basidiomycetes) V. Specimens from East Africa collected by L. Ryvarden. Mycotaxon 17:555-572.

—1987. Studies in Tropical Corticiaceae (Basidiomycetes) VII. Specimens from East Africa, collected by L. Ryvarden II. Mycotaxon 28:19-37.

—1987. A check-list to genera and species of corticioid fungi (Hymenomycetes). Windahlia 17:55-85.

—1991. *Athelopsis* instead of *Pteridomyces* (Corticiaceae, Basidiomycetes). Mycotaxon 42:149-154.

Hjortstam, K. and Larsson, K.H. 1994. Annotated check-list to genera and species of corticioid fungi (Aphyllophorales, Basidiomycotina) with special regards to tropical and subtropical areas. Windahlia 21:1-75.

Hjortstam, K. and Ryvarden, L. 1980. Studies in Tropical Corticiaceae (Basidiomycetes) I. Mycotaxon 10:269-287.

Langer, E. 1994. Die Gattung *Hyphodontia* John Eriksson. Bibl. Mycol. 154:1-298.

Langer, G. 1994. Die Gattung *Botryobasidium* Donk (Corticiaceae, Basidio mycetes). Bibl. Mycol. 158:1-457.

Liberta, A. E. and Navas, A. J. 1978. Notes on Venezuelan Corticiaceae (Basidiomycetes). Can. Jl Bot. 56:1777-1781.

Malençon, G. 1982. Nouvelles contributions à la flore mycologique du Maroc-III. Bull. Soc. Mycol. Fr. 98:18-248.

Rattan, S.S. 1977. The resupinate Aphyllophorales of the North Western Himalayas. Bibl. Mycol. 60:1-427.

Rodriguez-Armas, J.L., Ryvarden, L., Hallenberg, N. and Tejera, E.B. 1992. New and noteworthy species of Aphyllophorales (Basidiomycotina) from the Canary Islands. Mycotaxon 45:433-447.

Ryvarden, L. and Johansen, I. 1980. A preliminary polypore flora of East Africa. Fungiflora, Oslo, Norway. 636 pp.

Stalpers, J. A. and Buchanan, P.K. 1991. Type studies of the species of *Pellicularia* and *Peniophora* described by G.H. Cunningham. N.Z. Jl Bot. 29:331-340.

MYCOTAXON

Volume LX, pp. 191-200 October-December 1996

A NEW SPECIES OF *BARTALINIA* TASSI (DEUTEROMYCOTINA, COELOMYCETES)

Anderson, Freda[1] & Bianchinotti, Virginia[2]

1Departamento de Agronomía

2Departamento de Biología y Bioquímica
Universidad Nacional del Sur
San Juan 670 (8000) Bahía Blanca. ARGENTINA.

ABSTRACT

A fungus belonging to the genus *Bartalinia* Tassi was isolated from chlorotic leaves of *Mimosa rocae* (*Leguminosae*). As it could not be assigned to any of the known species it is here described as a new one under the name *Bartalinia mellea*. This is the first report of the genus for Argentina.

RESUMEN

Se aisló un hongo perteneciente al género *Bartalinia* Tassi a partir de hojas cloróticas de *Mimosa rocae* (*Leguminosae*). Como no pudo ser asignado a ninguna de las especies conocidas se lo describe como nueva bajo el nombre *Bartalinia mellea*. Esta constituye la primera cita del género para la República Argentina.

While carrying out research on diseases affecting endemic wild plant species in the south of Buenos Aires Province (Argentina), a specimen of *Mimosa rocae* Lorentz & Niederlain (*Leguminosae*) was collected because of the chlorosis observed on some of its leaves. *M. rocae* is the southernmost species of the genus and grows only on the hills in the south of Buenos Aires Province in Argentina and in Uruguay.

From this material a fungus belonging to the genus *Bartalinia* Tassi was isolated, but after close examination it could not be properly assigned to any of the known species of the genus.

In this paper we provide a full description of *Bartalinia mellea* which we propose as a new species.

MATERIALS AND METHODS

Isolation: The fungus was isolated from chlorotic leaves of *Mimosa rocae* on Potato Dextrose Agar (PDA). These were superficially desinfected with a tenfold dilution of a commercial bleacher (NaOCl).

Studies on host tissue: Leaves of *M. rocae* were treated at a pressure of one atmosphere for 20 minutes and inoculated later with the fungus. They were then incubated in a humid chamber at 25°C till fruiting bodies were formed.

Cultural studies: They were performed both on PDA and Malt Extract Agar (MA), both prepared according to Dhingra & Sinclair (1985).

Observations, photographs, and measurements of conidiogenous cells and conidia were made in tap water. Otherwise they were mounted in KOH and stained with phloxine 5%.

RESULTS

Bartalinia mellea Anderson & Bianchinotti, *sp. nov.*

Etymology: from Latin *melleus* (honey-coloured) referring to the colour of conidia.

Conidiomata eustromatica, superficialia, separata vel confluentia, forma irregularia, multilocularia, atro brunnea vel nigra; parietes crassi ex textura angularis, extra ex cellulis brunneis et intra ex cellulis pallidioribus compositi, parietes interloculares ex textura porrecta compositi, 76-560 x 76-305 μm.

Conidiophora simplicia vel irregulariter ramosa, pauci septata, hyalina, laevia, ex cellulis interioribus loculorum oriunda, 6-11 x 2-3 μm.

Cellulae conidiogenae holoblasticae, indeterminatae, discretae vel integratae, ampulliformes, cylindricae, subcylindricae vel irregulares, 3-13 x (1.5-) 2-3 (-4) μm.

Conidia ellyptico-fusiformia, transversa 4-euseptata, ad septa raro constricta, laevia, (16-) 19-24 (-27.5) x 3-4 (-5) μm. In culture (PDA) (19-) 24-29 (-32) x 3-5 μm. Cellula apicalis conica, hyalina, tenuitunicata, cum appendice singulari inserta, cum 3 rare 2-4 divergentibus, hyalinis, flexibilibus ramis, 14-24 μm long. Cellulae medianae cylindraceae, pallide brunneae vel ochraceae. Cellula basalis obconica, base truncata, subhyalina, cum appendice singulari simplici, excentrica, 6-15 μm long.

Coloniae in PDA atrovirentes, reverso atro, in MA fumosae, reverso fusco.

Typus: BBB 158.

Conidiomata stromatic, superficial, separate or confluent, plurilocular, irregular in shape, dark brown to black, 76-560 x 76-305 μm. Walls thick, composed of bright brown, thick-walled cells disposed in *textura angularis*, paler and thinner in the inner layers. Interlocular walls composed of thin-walled *textura porrecta*. Ostiole absent, dehiscence irregular by breakdown of the upper wall.

Conidiophores lining the inner layer of the conidiomata walls from which they originate, simple or irregularly branched, septate near the base, cylindrical to ampulliform, colourless, 6-11 x 2-3 µm.

Conidiogenous cells holoblastic, determinate or indeterminate, discrete or integrated, cylindrical, subcylindrical, ampulliform or irregular in shape, colourless, 3-13 x (1.5-) 2-3 (-4) µm.

Conidia cylindrical or fusiform, smooth-walled, straight to slightly curved, 4-euseptate, not (or only very slightly) constricted at the septa, (16-) 19-24 (-27.5) x 3-4 (-5) µm [mean = 21.7 x 3.4 µm]. Lenght/width mean: 6.5. In culture (PDA) (19-) 24-29 (-32) x 3-5 µm. [mean = 25.2 x 3.7 µm; lenght/width mean: 7]

Apical cell hyaline, conic, thin-walled, bearing a 3- (rarely 2 or 4) furcated hyaline appendage drawing out laterally from the apex. Appendage branches divergent, flexible, tapering gradually towards the apex, 14-24 µm long. [mean = 20 µm]

Median cells cylindrical, ochraceous to pale brown; the one next to the basal cell is always the longest: lenght/width ratio= 2,6 versus 1,5 for the others.

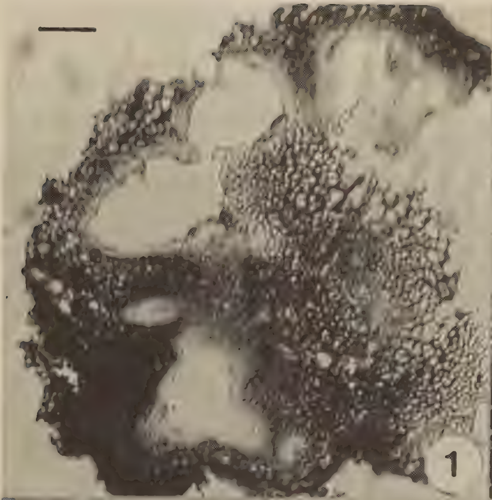
Basal cell obconic, attenuated at the base, subhyaline, with an exogenous, laterally inserted, hyaline appendage, 6-15 µm long. [mean = 10 µm]

Colonies in PDA deep green, black on the reverse, growing 4 cm/week. Colonies in MA smoky, brown on the reverse, growing slightly slower than on PDA. Mycelium immersed, branched, septate.

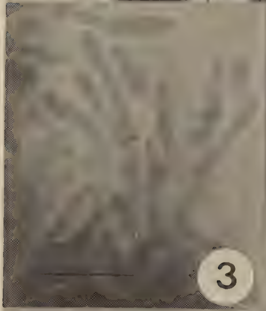
Type: Conidiomata on leaves inoculated with the fungus isolated from chlorotic leaves of *Mimosa rocae* collected from Co. Tres Picos, Villa Ventana, Buenos Aires Province, Argentina, Nov. 1988, Delhey & Anderson and dried cultures (PDA and MA) of an isolate from the same material (BBB 158).

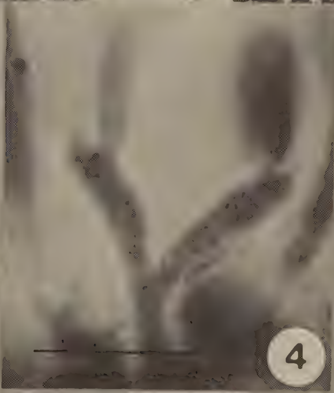
Teleomorph: unknown.
Known distribution: Argentina.

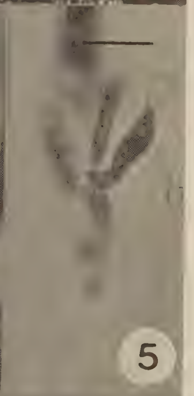
Figs. 1-8. ***Bartalinia mellea.*** Fig. 1. Vertical section through plurilocular conidiomata. Fig. 2. Section through interlocular walls. Figs. 3-5. Conidiophores. Figs. 6-8. Conidia. Notice an apical 4-furcated appendage (arrow). (Fig. 8. Phase contrast).
Scale bars: Figs. 1-2 = 50 µm, Figs. 3-8 = 10 µm.

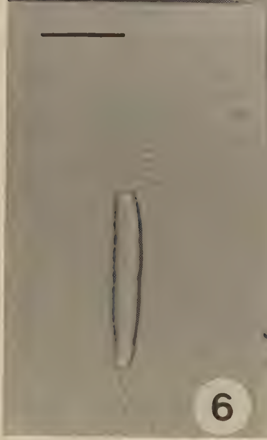

1

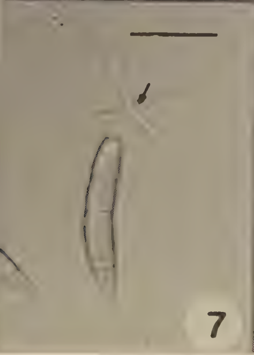
2


3


4


5


6


7

8

All the conidial cells have the capacity of germinating with the exception of the apical one. This cell is empty in mature conidia.

A comparison between the distribution of the lenghts of conidia in culture and on inoculated leaves was made (Fig. 10) on the basis of 80 measurements from each substratum. Conidia on PDA were longer, with higher frequencies between 24-27 µm while on leaves the highest frequencies observed were between 19-24 µm.

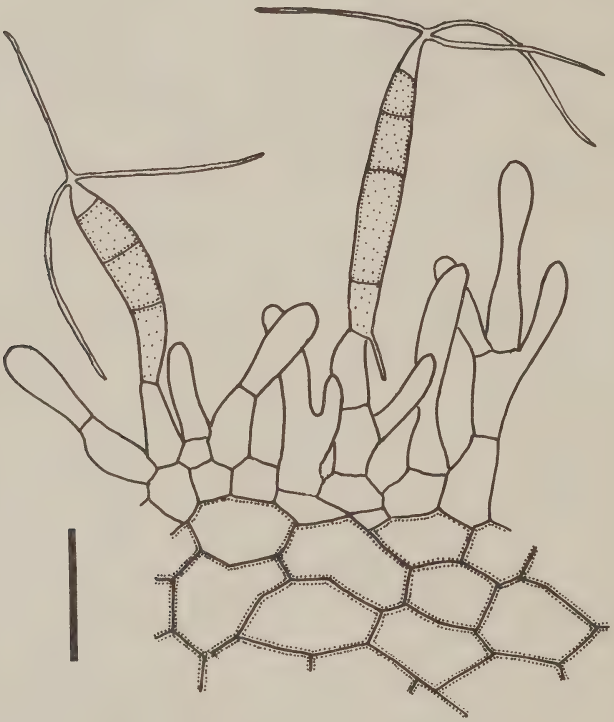


Fig. 9. ***Bartalinia mellea.*** Fertile hymenium. Scale bar: 10 µm.

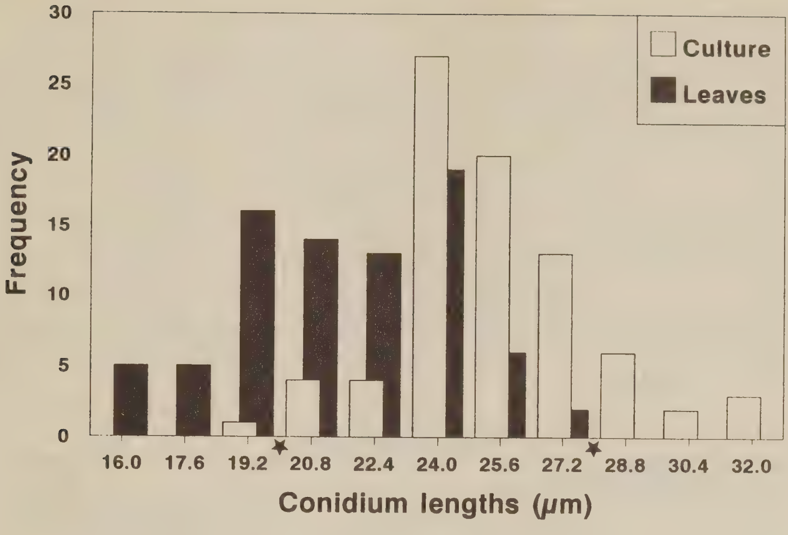


Fig. 10. Comparison between conidium lenghts of *Bartalinia mellea* from inoculated leaves of *Mimosa rocae* and from culture (PDA). *B. robillardoides* extreme measurements are indicated with ✶.

DISCUSSION

Among the species included by Nag Raj (1993) in the most recent review of the genus *Bartalinia* Tassi, *Bartalinia mellea* is closest to *Bartalinia robillardoides* Tassi for having conidia which are regularly 4-septate, but differs from it in a number of other characteristics (Table 1), the most salient being the nature of the conidiomata and conidiophores. *B. robillardoides* possesses smaller, unilocular fruiting bodies and conidiophores which are reduced to conidiogenous cells.

The production of plurilocular conidiomata, is a feature which *B. mellea* shares with *B. tamarindi* Nag Raj and *B. bischofiae* Nag Raj, however these two species have 3-septate conidia.

	B. robillardoides	***B. mellea***
Conidiomata		
nature	stromatic, pycnidioid to indeterminate	stromatic
locule configuration	unilocular	plurilocular
shape	globose, depressed-globose to angular	irregular
dimensions	180-240 x 80-200 µm	76-560 x 76-305 µm
Conidiophores		
	reduced to conidiogenous cells	developed, simple or branched
Conidiogenous cells		
	discrete	integrated or discrete
shape	ampulliform	cylindrical to ampulliform
dimensions	3-7 x 2-3 µm	3-13 x (1.5-) 2-3 (-4) µm
Conidia		
septation	4-septate	4-septate
shape	subcylindrical	cylindrical or fusiform
colour	almost colourless	ochraceous to pale brown
dimensions	20-28 x 3-3.5 µm	(16-)19-24(-27) x 3-4(-5) µm
mean length/width	7.1	6.5
Apical appendage		
branching	3-branched	(2-)3(-4)-branched
length	15-18 µm	14-24 µm
Basal appendage		
length	3-8 µm	up to 15 µm

Table 1: Comparison between ***Bartalinia robillardoides*** (*fide* Nag Raj, 1993) and ***Bartalinia mellea***.

There are other species in the genus which can produce well developed conidiophores (*viz. B. bischofiae*, *B. lateripes* (Ellis & Everheart) Nag Raj and *B. pistacina* (Maas) Nag Raj) but shape, size and septation of conidia readily distinguish *B. mellea* from them.

According to our observations conidium lenghts in culture varied substantially when compared to those on leaves (Fig. 10), but other features such as conidiomata characteristics, nature of conidiophores, morphology of conidiogenous cells and conidia remained the same. The stability of these features strenghtens our trust in their reliability as basis for the description of this new species.

This is, in our knowledge, the first report of a species of the genus *Bartalinia* Tassi in Argentina. *B. cordylines* (Speg.) Höhnel cited by Guba (1961) for Argentina is a mistake according to Nag Raj (1993) since Höhnel never published this combination. The fungus originally described by Spegazzini (1910) as *Pestalozzina cordylines* is today *Zetiasplozna cordylines* (Speg.) Nag Raj.

The genus has already been recorded in Brazil, but the species described from that country have not been formally accepted (Nag Raj, 1993).

ACKNOWLEDGMENTS

We are very grateful to Dr. T.R. Nag Raj for having examined our material and for his very helpful suggestions during the development of this study. We are also greatly indebted to Lic. Marta Garelli for improving the Latin diagnosis and to Dr. G.H. Boerema for reviewing our manuscript. We wish to thank Dr. Rolf Delhey very specially for his constant advice and encouragement .

Partial financial suppport was provided by the CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas de la República Argentina) and by the Universidad Nacional del Sur. MVB has a Posdoctoral Fellowship from the CONICET.

LITERATURE CITED

Dhingra, O.D. & Sinclair, J.B. 1985. *Basic Plant Pathology Methods*. Boca Ratón. Florida. 355 pp.

Guba, E.F. 1961. *Monograph of Monochaetia and Pestalotia*. Harvard University Press, Cambridge, Massachusetts, U.S.A., 342 pp.

Nag Raj, T. R. 1993. *Coelomycetous anamorphs with appendage-bearing conidia*. Mycologue Publications, Waterloo, Ontario, Canada, 1101 pp.

Spegazzini, C. 1910. Mycetes Argentinenses. *An. Mus. Nac. Bs. As.* 20 (ser. 3 v. 13): 372.

MYCOTAXON

Volume LX, pp. 201-212 October-December 1996

PINATUBO ORYZAE GEN. ET SP. NOV. AND ITS IDENTITY DURING ROUTINE TESTS OF RICE SEED

J. B. Manandhar[1] and T. W. Mew[2]

[1]Molecular Genetics Research, 21/241 Dilli Bazar, Kathmandu, Nepal and
[2]International Rice Research Institute, P. O. Box 933, 1099 Manila, Philippines.

Abstract: *Pinatubo* Manandhar & Mew and *P. oryzae* Manandhar & Mew are new genus and species respectively for our new fungus isolated from rice seed lots grown in the Philippines. *P. oryzae* produces 2 kinds of hyaline, oboviform to pyriform sympodio-conidia; 1-septate, dry, 6.7-10.2 x 2.2-3.3 µm (average 8.2 x 2.5 µm) conidia from solitary conidiophores and 0-septate, wet, 5.6-8.4 x 1.8-2.6 µm (average 6.7 x 2.1 µm) conidia from sporodochial conidiophores on the same niche. In sporodochium, first conidium initiates on minute denticle near the tip of a conidiophore, second conidium initiates similarly by elongating the axis just below the first conidial attachment displacing it to a side, and so on forming a heap of conidia. The fungus is weakly parasitic to germinating rice seedlings showing chlorotic gray lesions on plumules. *P. oryzae* occurs on most seed lots of rice grown in the Philippines. Higher percentage of the fungus was detected in seed lots produced during wet than dry season.

Introduction: Our new fungus is frequently encountered in rice seed lots grown in the Philippines that forms morphologically different sympodio-conidial anamorphs, solitary conidiophores and sporodochial conidiomata on the same niche, which we believe it belongs to new genus. Genus *Pinatubo* is erected to place this fungus. *Arthrobotrys* was created by Corda (1839) for hyphomycetes with uniseptate, hyaline conidia with an apiculiform base, that develop on sterigmata arranged in whorls on the tips and nodes of septate conidiophores. The genus was based on the type specimen, *A. superba* Corda. Nematode-capturing hyphal networks in *A. superba* were described later by Zopf (1888). Cooke and Godfrey (1964) prepared a key for 12 species of *Arthrobotrys* having adhesive hyphal branches, networks, constricting or nonconstricting rings and aerial sticky knobs to capture live nematodes. Haard (1968) updated the key for 12 species of *Arthrobotrys* with uniseptate conidia either borne on nodules or not and with predaceous organs to capture live nematodes. The synnematous saprobic *A. stilbacea* Meyer was excluded by Haard (1968) on the grounds that it probably belonged to another genus. Barron and Davidson (1972) described *A. anomala* Barron & Davidson in *Arthrobotrys* although it has nonseptate conidia on the grounds that conidia become uniseptate before germination and the species has adhesive hyphal branches. Jarowaja (1970) and Schenck et al. (1977) re-evaluated and broadened the generic concept of *Arthrobotrys* and amalgamated 31 and 47 species respectively of nematode-trapping hyphomycetes with distinctly denticulate conidiophores. Jarowaja (1970) included typically 1-septate hyaline conidia, while Schenck et al. (1977) included species with 0 to pleuriseptate hyaline conidia such as new species *A. amerospora* Schenck, Kendrick & Pramer. *Arthrobotrys stilbacea* is a saprophyte isolated from palm leaves in the former Belgium Congo (Meyer, 1958), but Jarowaja (1970) and Schenck et al. (1977) included it within their expanded generic concept of *Arthrobotrys* without proof of its nematophagous properties. Oorschot (1985) re-evaluated and accepted 31 species that includes 5 varieties of *Arthrobotrys* restricting 0 to 3 septate hyaline ovoid to clavate conidia borne on short denticles. Synnematous fungi, *A. stilbacea* is excluded but *A. dendroides* Kuthubutheen, Muid & Webster included based on the nematode-trapping nature in the current generic concept of Oorschot (1985). Current literature review shows *A. constringens* Dowsett, Reid & Kalkat (Dowsett et al., 1984), *A. ferox* Onofri & Tosi (Onofri & Tosi, 1992) and *A. pauca* McCulloch (McCulloch, 1977) have been described but have not added to the expanded genera of *Arthrobotrys*.

A fungus was frequently encountered in 2-80% of seeds in rice seed lots grown in the Philippines. This fungus occurs both on germinated and non-germinated seeds concealing more pathogenic fungi. This fungus appears to be a new genus *Pinatubo* and new species *P. oryzae* and is described below.

Materials and methods: Fungal structures were picked up directly from culture plates or from infected or infested grains into a drop of lactophenol with 0.3% cotton blue or a 1 M KCl on a slide; a cover slip was applied and sealed with nail polish. Chlamydospores were directly transferred to a drop of glycerin to examine the color. Fungal structures were measured and camera lucida drawings were made using a 100x objective of a compound microscope, except for some solitary conidiophores and pionnotes which were observed with a 10x objective. The test fungus was grown twice on 5 plates each of potato dextrose agar (PDA) or 2% water agar (WA) at 28°C under a 12-hr photoperiod and measured its colony diameter in 7 days after inoculation.

Four-hundred seeds of each of 20 cultivars (IR 8, IR 20, IR 32, IR 36, IR 38, IR 42, IR 44, IR 48, IR 50, IR 52, IR 54, IR 56, IR 58, IR 62, IR 68, IR 70, IR 72, IR 74, PSBRc 2, and PSBRc 4) grown at the International Rice Research Institute (IRRI) at Los Baños, Laguna during 1992 wet season or 1993 dry season were plated by the wet blotter paper method (Mia et al. 1985; Nath et al. 1970), incubated under continuous near ultraviolet light for 7 days at 25°C, and examined with a binocular microscope to compare the percent and degree of infestation due to *P. oryzae* in dry versus wet season. Degree of infestation was based on the percentage cover of fungal hyphae on the rice seeds or seedlings in 7 days, where 0 = none to 9 = 100% surface covered by the fungus. There were 25 seeds per plate, 4 plates per replication and 4 replications.

Individuals of *Aphelenchoides besseyi* Christie were isolated using the Baerman funnel method (Southey, 1986) from the rice seeds of line IR 19319-5-3-3-2-1 grown in the 1992 wet season. Thirty nematodes were surface-sterilized in 1% streptomycin sulfate for 2-3 min and washed 3 times in sterilized distilled water and then transferred to 3-day old colony of *Alternaria alternata* (Fr.) Keissler (isolated from rice seed) grown on PDA as described by Southey (1986) and incubated at 28°C and a 12-hr photoperiod for 10 days. Nematodes from *A. alternata* cultures were then picked up and surface-sterilized as described above. Thirty nemas per 9-cm diam plate were placed on a 3-day-old colonies of *P. oryzae* grown on PDA or WA to study whether or not this fungus is nematophagous. A small chunk of an *P. oryzae*. Colony was cut, transferred to a plate containing sterile water and approximately 100 nematodes were then picked up randomly and transferred to a drop of glycerin, a briefly warmed, and examined under a compound microscope to find fungal structures inside nematodes.

Results and discussion

Pinatubo Manandhar et Mew gen. nov. et ***P. oryzae*** Manandhar et Mew sp. nov. (figs. 1-31).

Hypha sola hyalinum, laevibus, ramosis, rectis, septatum. Conidiophora solitarius lata simplicia vel 1-2 ramosae, 1-4 septatis, hyalina, indeterminata ad oryza seminibusque, cellae conidiogenae apice 0.7-2.0 µm latae et denticulae 0.7-1.3 x 0.6 µm, plerumque 3-7 conidiis in capitulo laxum ferentes. Conidiis solitarius hyalina, didymosporae; cellae aequalibus, oboviformis usque piriformis usque clavatis, 6.7-10.2 x 2.2-3.3 µm ad substratis naturalibus, apice rotunda sensim adbasem tenuem, angusto truncatoque fundamento minuentia. Sporodochiis conidioma, pionnotes instratis, humido, pulvinata, persicino ochraceis, liberis ad aërio hyphis in oryza seminibusque. Conidiophora et cellae conidiogenae similis, 1-pluri (plerumque 3-5)/conidiophora-mater-cella, lageniformis usque cymbiformis, cum partapicem sporiferum flexuosa, capitulo laxum ferentes, muricatus vel veruculosae et ventricoso rostrata, lecithiforme cum apice veruculosae. Cicatrices conidiales conspicuae, saepe 0.3 x 0.3 µm, primo terminates, denique in positionem lateralem submotae et saepe plus minusve turgeo prominentes. Conidiis sporodochis oboviformis usque piriformis usque clavatis, sympodice producta, acrogenosa, minutulae denticulata, amerosporae, raro 1-septatis, humidis et in massis persicino ochraceis, 5.6-8.4 x 1.8-2.6 µm ad seminibusque, apice rotundatis sensim adbasem tenuem, angusto truncatoque fundamento minuentia. Chlamydosporae intercalares in hyphis, 1-2 mm densus, subter-aërio mycelio et PDA superficies, subglobosae usque rectangularis.

Pinatubo Manandhar & Mew new genus and ***P. oryzae*** Manandhar & Mew (figs. 1-31). This fungus is named after the legendary volcanic mountain Mt. Pinatubo of the Philippines that was erupted last July 1991.

Fungi imperfecti, hyphomycetes, colony effuse with sparse solitary conidiophores and pionnotes, mycelium partly superficial and partly immersed, 65 mm diam in 7 days at 28°C, colorless with grayish powdery solitary conidiophores and tan, papillate sporodochia on WA (figs. 24 b and d); 31 mm diam in 7 days at 28°C, surface velutinous white, reverse peach yellow due to dense chlamydospores on PDA (figs. 24 a and c); sparse to floccose hyphae with sparse to dense solitary conidiophores and pionnotes amphigenous on rice grains (figs. 25-27); *mycelium* superficial, hyaline, smooth, branched, septate, 0.8-2.1 μm across. *Solitary conidiophores*, sparse to abundant in aerial mycelia on rice seeds and on PDA, straight from lateral hyphae, macronematous, smooth, erect or suberect, simple or 1-2 branches, 1-4 septate (figs. 1, 26 and 29); sparse to numerous, branched 200-400 μm tall on WA (Fig. 2); polyblastic, hyaline, indeterminate, raduliforme, 21.2-84.8 μm tall, base 1.6-2.7 μm wide, near apex 0.7-2.0 μm

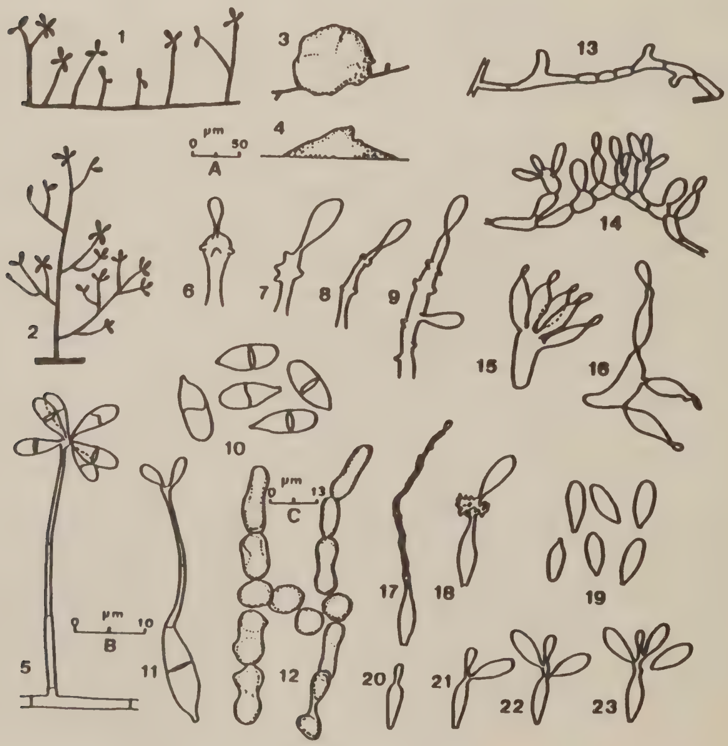


Figure 1-23. Camera lucida illustrations of *Pinatubo oryzae*: **1**. Simple to lightly branched solitary conidiophores arising from an aerial hypha on the natural substratum (infested rice seed) or on potato-dextrose agar (PDA); **2**. A much branched solitary conidiophore arising from the superficial hypha on the surface of 2% water agar (WA); **3**. Subglobose sessile pionnote on or above the natural substratum hung on its hypha; **4**. Lateral view of a superficial pionnote with heaping-up of sporodochial conidia on WA; **5**. Close-up view of a solitary conidiophore with an apical cluster of 2-celled solitary conidia on the natural substratum or on PDA; **6-9**. Denuded solitary conidiophore apices, showing variations in length and arrangements of spore-bearing spurs with more common capitate head on natural substratum (**6**), dilated head often found on the natural substratum (**7**), and less commonly found racemes apices on the natural substrata but common on the cultural media (**8** and **9**); **10**. Variations of solitary conidia formed on solitary conidiophores; **11**. A giant conidium producing secondary conidiophore and conidia; **12**. Catenate chlamydospores formed in older hyphae from PDA; **13**. Initial development of a sporodochium by thickening and branching of a single hypha; **14**. Development of conidiophore-mother-cells and conidiophores; **15** and **16** Sporodochial conidiophore-mother-cells showing variations in length, shapes and bearing the number of conidiophores; **17** and **18**. Conidiophores showing flexuous conidiogenous cells in the terminal portion formed on WA and on the natural substratum under wet environment (**17**) and a warty or coralloid terminal portion formed under drier environment (**18**); **19**. Sporodochial conidia showing variations in shape and size; **20-23**. Successive development of the sporodochial conidia and the terminal portion of the conidiogenous cell giving birth of first conidium on a minute denticle on the top of a clavate-shaped conidiophore (**20**), second conidium initiated on similar minute denticle by elongating the axis just below the first conidial attachment displacing it to a side (**21**), third conidium borne on new axis at the extremity of the second conidium displacing the second conidium as before (**22**), and fourth conidium borne similarly displacing the third conidium a side and by that time first and second conidia dislodge depending upon their maturity and possibly the force exerted by the tufts of developing conidiophores and sporodochial conidial mass (**23**). Bar for Fig. 1 to 4 is scale A, for 12 is scale B, and for 5-11 and 13 to 23 is scale C.

wide on PDA and on rice grains (figs. 5,.6 and 29), mostly 3-7 solitary conidia in apical clusters with mostly capitate head (figs. 6 and 29) and dilated tip (fig. 7) in natural substrate and few racemes types (figs. 8 and 9) on agar medium. Most *solitary conidia* borne in apical clusters (figs. 5 and 29), some borne in series of clusters or irregularly along spore-bearing apex on minute subcylindrical 0.7-1.3 x 0.6 μm denticles (figs. 7 to 9), oboviform to pyriform to clavate, holoblastic, acropleurogenous, dry, 2-celled, equal celled, 6.7-10.2 x 2.2-3.3 μm (average 8.2 x 2.5 μm) on rice grains, 6.9-11.3 x 2.4-3.5 μm (average 9.8 x 2.9 μm) on WA, apex rounded, apiculiform with minute

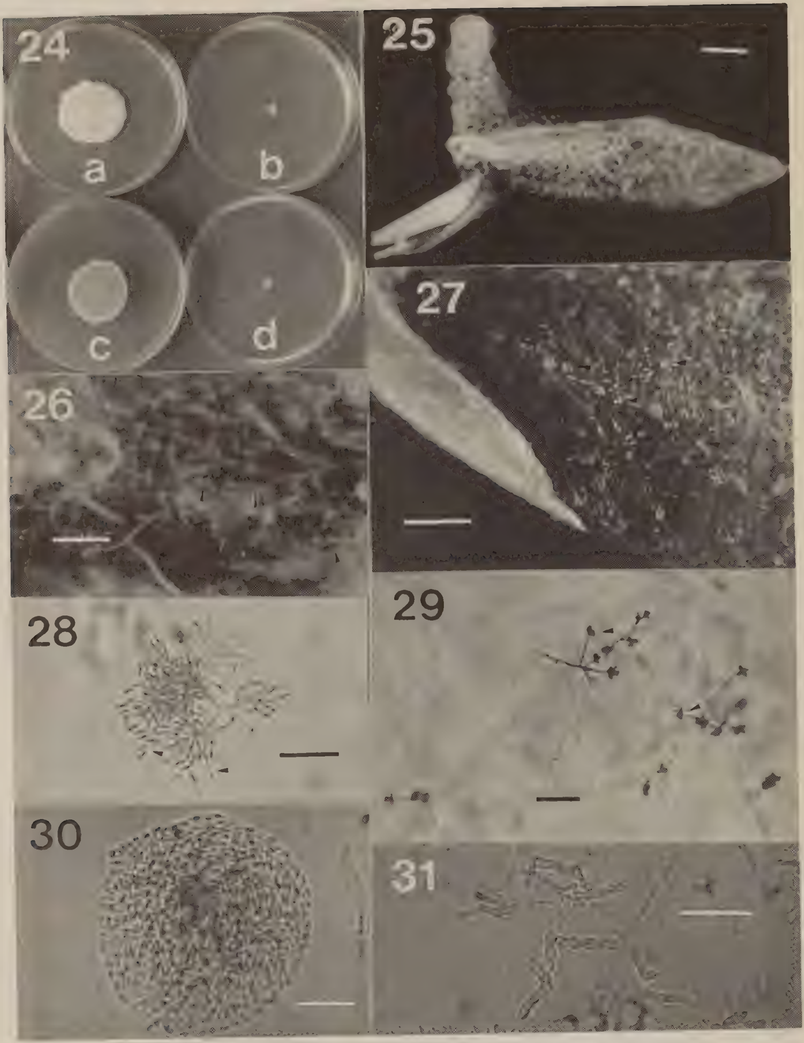


Figure 24 to 31. Photomicrographs of *Pinatubo oryzae*. **24.** Colony characteristics of the fungus on potato-dextrose agar (PDA) (**a**), 2% water agar (WA) (**b**), reverse view on PDA (**c**) and on WA (**d**) grown in 9-cm diam plastic Petri dish 7 days after incubation at 28°C and 12-hr photoperiod (fluorescent light); **25.** Growth of the fungus on a germinating rice grain in 10 days after incubation on blotter method; **26-27.** Close-up view of the fungus on the rice grain showing solitary conidiophores and conidia (arrows) (**26**) and pionnotes (arrows) (**27**); **28.** A washed pionnote showing sporodochial conidiogenous cells and young conidia (arrows); **29.** Solitary conidiophores and conidia; **30.** A heap of sporodochial conidia on a sporodochium on WA; and **31.** Chlamydospores. Bars in fig. **25** = 1 mm, in figs. **26-27** = 8 mm and in figs. **28-31** = 50 µm.

truncate base at the attachment end (fig. 10), larger than sporodochial conidia. Solitary conidia germinating from the base of the proximal cells and/or the near apex of distal cells. Giant conidia rare, 10-13 x 3-5 µm, 1-2 septate, while attached to conidiogenous cells produce secondary conidiogenous cells and smaller and smooth secondary conidia (fig. 11). *Sporodochial conidioma*: Pionnotes on rice grains (figs. 3 and 27) and on WA (figs. 4, 27 and 30) sparse, pulvinate, peach yellow, 47-128 µm diam, stroma absent or loose. Individual hyphae (fig. 13) thickened, branched, forming ovate to clavate conidiophore-mother-cells (Figs 14 to 16), 4.5-7.5 x 2.3-4.5 µm, branching 2-4 times in older sporodochia. *Sporodochial conidiophores* not different from conidiogenous cells (figs. 15 and 16), tufts of conidiogenous cells, short, abundant, 1 to many (mostly 3-5) per conidiophore-mother-cell, lageniform to cymbiform, basal portion 6.6-14.4 x 2.3-3.6 µm, with elongated, flexuous, non-septate, roughened with numerous minute subcylindrical denticles mostly 0.3 x 0.3 µm, terminal portion of the conidiogenous cell 0-35 x 1-2 µm in WA (figs. 17 and 28) but elongated 4.5-8.2 µm long or lecithiform with warts 2-4 µm diam on rice grains (fig. 18). *Sporodochial conidia* born holoblastically at the flexuous or warted tip of the conidiogenous cell displacing older sporodochial conidia to one side, dislodged when mature leaving a conspicuous flat to slightly raised conidial scar (figs. 20 to 23), acrogenous, oboviform to pyriform, occasionally clavate; wet, hyaline, rounded apex, minute truncate base, amerospores, 5.6-8.4 x 1.8-2.6 µm (average 6.7 x 2.1 µm) on rice grains and 6.2-8.5 x 2.1-3.0 µm (average 7.3 x 2.4 µm) on WA, rarely 1-septate, produced sympodially on minute denticles, peach yellow in mass (fig. 19), smaller than solitary conidia. First sporodochial conidium formed on a minute denticle at the top portion of the sporodochial conidiogenous cell as blown-out obovate cell, elongation of the axis occurs with the production of the second sporodochial conidium as a blown-out obovate cell just below the attachment of the first conidium and so on. The first formed sporodochial conidium is detached before or after the fourth sporodochial conidium is produced causing terminal portion of the conidiogenous cell to be somewhat helicoid (figs. 20-23). *Chlamydospores*, intercalary in hyphae, holothallic, thick-walled in a dense mat, 1-2 mm thick in between aerial mycelium and surface of PDA, 6.3-11.8 µm diam when subglobose, 8.2-15.9 x 3.5-6.0 µm when rectangular to hourglass shaped, peach yellow in mass, yellowish individually (figs. 12 and 31).

Habitat: On and in seeds and germinating seedlings of rice (*Oryza sativa* L.) grown in the Philippines

Type: Original living cultures were deposited in American Type Culture Collection (ATCC 90547) and Centraalbureau voor Schimmelcultures (CBS 158.94)., and infected or infested dried rice seeds were deposited in the

University of Philippines at Los Baños (UPLB) Herbarium Deposition Number 10284, Laguna, Philippines.

Detection of *Pinatubo oryzae* in rice seeds: Two to 51% seeds were infested with *P. oryzae* (table 1) among 20 seed lots (20 cultivars) grown at the IRRI fields during the 1992 wet season, while 0 to 10% seeds in the 1993 dry season. Seeds were infested with the fungus during both dry and wet seasons, with a significantly ($P = 0.05$) higher percentage of seed infestation during wet than dry season, however, the degree of infestation was not significantly different (table 1). *P. oryzae* was found to cause seed rot and weaken germinated seedlings showing yellowish gray lesions on plumules.

Nematodes of *A. besseyi* were not parasitized by *P. oryzae*. No constricting rings, loops, 3-dimensional networks or sticky knobs were found.

Table 1. Percent and degree of infestation due to *Pinatubo oryzae* on 40 seed lots grown at the IRRI farm during 1992 wet season and 1993 dry season based on 400 seeds of 20 cultivars.

	Detection of *P. oryzae* on seeds		
Infestation	Range	Percent	Degree[a]
1992 wet season	2-51	13 a[b]	4
1993 dry season	0-10	2 b	3
$LSD_{0.05}$		10	NS

[a] Based on the surface coverage with the fungal hyphae, where 0 = none to 9 = 100% cover.

[b] Numbers following different letters are significantly different by FLSD.

Identifying Clues for *Pinatubo oryzae* during routine seed health test: The fungus abounds on rice at the IRRI central research farm at Los Baños. The fungus was detected in 0 to 51% seeds in rice seed lots produced by farmers in the Philippines. Record shows *P. oryzae* seed infestation was first detected in 1982. However, no record of biological control of *A. besseyi* using *Arthrobotrys* spp. in rice plants was found in the Philippines. The fungus is also believed to conceal many other pathogens from detection during routine seed health testing of the rice seeds in the blotter tests.

P. oryzae can be identified from its sparse to dense white mycelial cover on the seeds when viewed under 12x magnified objective (fig. 25), its capitate arrangement of dry, powdery solitary conidia at the tips of the conidiophores when viewed under 25x magnified objective (figs. 26 and 29); and the presence of sparse creamy wet pionnotes hanging under a thin cover of aerial hyphae (fig. 28), but which may turn sub-globose to irregular, wet, light to pink on rice seeds on blotter in 7 days. Aerial conidiophores may look like conidial heads of *Sarocladium oryzae* (Sawada) W. Gams & D. Hawksw. and *Verticillium luteo-album* (Link:Fr.) Subram. under 12x magnified objective. However, one can view characteristic triangular or cruciform arrangement of solitary conidia in apical clusters of *P. oryzae* when surface viewed under a 25x magnified objective to differentiate it from the rest of the sporulating fungi. *S. oryzae* forms shiny, cream-colored heads and *V. luteo-album* forms verticillate conidiophores in globose heads as seen under a 25x magnified objectives. Pionnotes of *P. oryzae* are distinctly different from pionnotes of *Fusarium* Link:Fr., being of coarse texture and macroconidial origin (Nath et al. 1970). Pionnotes of *P. oryzae* may look like pionnotes of *Gerlachia oryzae* (Hashioka & Yokogi) W. Gams, being similar in texture and color. *G. oryzae* tends to form pionnotes in chains on the surface of the seed and mostly without mycelial cover (Mia et al. 1985) when viewed under the compound microscope. Conidia of *G. oryzae* are 2-celled, sickle-shaped and larger than those of *P. oryzae*.

New genus *Pinatubo* is erected to place this fungus on the basis of similarities in the nature of solitary conidiophores but dissimilarity in the nature of sporodochial conidiomatal anamorphs in the same niche (on rice seed or agar cultures) to the original or subsequently revised description of *Arthrobotrys*. Sympodio-conidiation occurs on both solitary conidiophores producing uniseptate conidia and sporodochial conidiophores producing nonseptate conidia on *P. oryzae*. Separate names for the solitary conidiophore anamorph producing uniseptate conidia and the sporodochial anamorph producing nonseptate conidia is not necessary according to the International Code for Botanical Nomenclature Articles 7.10 and 59.3. Solitary conidiophore and sporodochial conidioma are synanamorphs of *P. oryzae* according to Gams (1982). Two-celled conidia formed in the solitary conidiophores of *P. oryzae* are smaller than the smallest conidia in the genus *Arthrobotrys*, *A. stilbacea* with dimension of 10.5-14 x 4-4.5 µm (Meyer 1958), but has near identical dimensions on larger conidia forming species of the genus *Sporothrix* Hektoen & Perkins. Conidial dimensions of *S. vizei* (Berk. & Br.) de Hoog are 6-9 x 2.5-3.5 µm, but they are 1-celled formed in solitary conidiophores with 3-4 conidia per apical cluster (de Hoog, 1978). Similarities of the sporodochial anamorph and production of one-celled sympodio-conidia are found in the genus *Beauveria* Vuill., but the conidia in this genus are dry, globose to oval, and smaller (MacLeod, 1954). Dimensions of 1-celled sporodochial conidia of *P. oryzae* are larger than the largest conidia formed in the genus *Beauveria*, *B. tenella* (Delacr.) Siem. which are mostly 2-4 x 1.5-2.5 µm (MacLeod, 1954). Denticles on solitary conidiophores of *P. oryzae* resemble fungicolous *Eriomycopsis* Speg. in shape and size; and condial dimension of *E. minuta* Deighton & Pirozynski which are mostly 7.5-14 x 1.3-1.8 µm (Deighton and Pirozynski, 1972) is close to the dimension of solitary conidia of *P. oryzae* but differs in the shape. *P. oryzae* has two morphologically different anamorphs that do not fit the combinations of features described for any known species of the genera *Arthrobotrys*, *Beauveria*, *Eriomycopsis* or *Sporothrix*. We erected the genus *Pinatubo* and named our fungus as *P. oryzae* because of dissimilarities to the genus *Arthrobotrys* following the expanded generic concept of Schenck et al. (1977) and Oorschot (1985) that has not been described before or after 1977 and *Eriomycopsis* following the expanded generic concept of Deighton and Pirozynski (1972) that has not been described before or after 1972; by sympodially proliferating conidiogenous cells on both solitary conidiophores producing macroconidia and sporodochial conidiomata producing microconidia in gloeoid mass having more or less conspicuous minute subcylindrical denticles. The fungus did not show any affinities of forming hyphal constriction rings or loops, 3-dimensional networks or sticky knobs to capture the seed-borne nematodes of rice, *A. besseyi* that multiplied rapidly on the test fungus. *P. oryzae* was not found to be fungicolous. We presumed that *P. oryzae* is adapted being resident of rice panicles and seedlings, but its interaction with rice and other microorganisms is a subject to study.

Three different conidia are found in the genus *Fusarium*, in which septate pedicellate conidia (macroconidia) produced from sporodochia bearing phialo-conidiogenous cells are larger than nonpedicellate conidia (microconidia) produced from solitary phialo-conidiogenous cells, while mesoconidia are produced from solitary sympodio-conidiogenous cells (Pascoe, 1990). Sporodochial conidia produced in *P. oryzae* are unicellular and smaller than two-celled solitary conidia formed on the solitary conidiophores and might be termed here as microconidia, while macroconidia might be used for those produced on the solitary conidiophores. It is believed that the ability of conidia to be detached by vibration and dispersed by air current is apparently related to sympodio-conidiogenesis. Solitary conidia of *P. oryzae* are dry, while sporodochial conidia are wet, being disseminated by air or rain splash with equal reliability. This fungal species demonstrating sympodio-conidia produced on the sporodochium being wet spores (figs. 28 and 30). It is not known how mucilage is produced in *P. oryzae* to prevent sporodochial conidia from being dry. It is presumed that sporodochial conidia are forced to detach by underlying numerous flexuous conidiogenous cells and developing sporodochial conidia in situ (figs. 20 to 23), thereby a brief flow of cytoplasmic mucilage might have occurred. Denticles are smaller on sporodochial conidiogenous cells than on the solitary conidiogenous cells.

Conidial shapes of *P. oryzae* normally seen on the infested rice grains are described above. Measurements were made in 1 M KCl. However, conidial measurements in 1 M KCl were larger, from solitary conidiophores mostly 7.6-10.6 x 2.6-4.2 µm (mean 9.2-3.2 µm) and from sporodochial conidioma mostly 6.2-10.3 x 2.3-3.4.3 µm (mean 7.8 x 3.2 µm) with some of them become obovate and somewhat constriction in the septum making workers difficult to recognize fungal species (Mankau 1989).

Acknowledgment: Authors greatly indebted to Dr. Jack D. Rogers, Department of Plant Pathology, Washington State University, Pullman, WA 99164, Dr. C. A. Shearer, Department of Biology, University of Illinois, Urbana, IL 61801 and Dr. Walter Gams, Centraalbureau voor Schimmelcultures, 3742 SK Baarn, the Netherlands for reviewing the manuscript and inspection of the fungus. Thanks are also due to E. G. Gonzales, P. G. Gonzales, C. C. Huelma and S. D. Merca for technical details.

Reference cited:

Barron, G. L., and Davidson, J. G. N. 1972. Nematophagous hyphomycetes: *Arthrobotrys anomala* sp. nov. Can J. Bot. 50:1773-1774.

Cooke, R. C., and Godfrey, B. F. S. 1964. A key to the nematode-destroying fungi. Trans. Br. Mycol. Soc. 47:61-74.

Corda, A. C. F. 1839. Pracht-Flora europaeische Schimmelbildungen. Lipzig & Dresden: G. Fleischer.

Deighton, F. C., and Pirozynski, K. A. 1972. Microfungi. V. More hyperparasitic hyphomycetes. Mycological Paper 128, 1-110.

Dowsett, J. A., Reid, J., and Kalkat, R. S. 1984. A new species of *Arthrobotrys* from soil. Mycologia 76:559-562.

Gams, W. 1982. Generic names for synanamorphs? Mycotaxon 15:459-464.

Haard, K. 1968. Taxonomic studies on the genus *Arthrobotrys* Corda. Mycologia 60:1140-1159.

Hoog, G. S. de 1978. Notes on fungicolous Hyphomycetes and their relative. Persoonia 10:33-81.

Jarowaja, N. 1970. The genus *Arthrobotrys* Corda. Acta Mycologica 6:337-406.

MacLeod, D. M. 1954. Investigation on the genera *Beauveria* Vuill. and *Tritirachium* Limber. Can. J. Bot. 32-818-890.

Mankau, R. 1989. Problems in taxonomic differentiation of nematode-trapping fungi. J. Nematol. 21:572 (Abstr.).

McCulloch, J. S. 1977. New species of nematophagous fungi from Queensland. Trans. Br. Mycol. Soc. 68:173-179.

Meyer, J. A. 1958. Appareil conidien de *Trichothecium roseum* Lk. ex Fr., *Cylindrocarpon congonsis* nov. sp. et *Arthrobotrys stilbacea* nov. sp. Bull. Cociete Mycol. France 74:236-248.

Mia, M. A. T., Mathur, S. B., and Neergaard, P. 1985. *Gerlachia oryzae* in rice seed. Trans. Br. Mycol. Soc. 84:337-338.

Nath, R., Neergaard, P., and Mathur, S. B. 1970. Identification of *Fusarium* species on seeds as they occur in blotter test. Proc. Int. Seed Test. Assoc. 35:121-144.

Onofri, S., and Tosi, S. 1992. *Arthrobotrys ferox* sp. nov., a springtail-capturing hyphomycetes from continental Antarctica. Mycotaxon 44:445-451.

Oorschot, C. A. N. van. 1985. Taxonomy of *Dactylaria* complex, V. A review of *Arthrobotrys* and allied genera. Studies in Mycology, No. 26, 61-91.

Pascoe, I. G. 1990. *Fusarium* morphology I: Identification and characterization of a third conidial type, the mesoconidium. Mycotaxon 27:121-160.

Schenck, S., Kendrick, W. B., and Pramer, D. 1977. A new nematode-trapping hvand a reevaluation of *Dactylaria* and *Arthrobotrys*. Can J. Bot. 55:977-985.

Southey, J, F. 1986. Laboratory Methods for Work with Plant and Soil Nematodes. Ministry of Agr., Fish. Food, London, 202 p.

Zopf, W. 1888. Zur Kenntniss der Infections-Krankheiten neiderer Thiere und Pflanzen. Nova Acta Leop.-Carol. Deut. Acad. Naturf. 52:314-376.

MYCOTAXON
Volume LX, pp. 213-224 October-December 1996

A PRELIMINARY CHECKLIST OF AGARICALES OF TURKEY

ERTUĞRUL SESLI AND SAFFET BAYDAR

Faculty of Fatih Eğitim (Education), Department of Biology, University of Karadeniz (Black Sea) Technical, 61335 Trabzon-TURKEY

ABSTRACT

This paper presents a complete list of the members of the Agaricales identified by the authors and other scientists since the beginning of macrofungal studies in Turkey (1932). Species listed here (table 1) belong to 17 families of Agaricales. The collection of species newly listed for Turkey by authors are deposited in the Herbarium of the Faculty of Fatih Eğitim (Education) of the Karadeniz (Black Sea) Technical University.

INTRODUCTION

Turkey has a very divers flora, and many studies have been carried out concerning the phanerogamic component. However, the cryptogamic flora has not been studied as extensively.

The main studies concerning the Agaricales in Turkey were made by Pilát (1932, 1933), Lohwag (1957, 1964), Selik (1965), Selik and Aksu (1967), Öder (1982, 1986, 1988), Öner (1972), Karamanoğlu and Öder (1973), Kotlaba (1976), Sümer (1989), Watling and Gregory (1977), Gücin and Öner (1982), Gücin (1987, 1990), Işıloğlu and Watling (1992), Demirel and Işıloğlu (1993), Öztürk et al. (1990), Asan and Gücin (1990), Solak and Gücin (1990, 1992), Sesli (1993) and Baydar and Sesli (1994).

All of these studies focus on Turkish larger fungi. There is no distinct study devoted to Agaricales. In fact, there is no paper compiling the Turkish Agaricales found by the scientists listed above. This paper provides the first summary of knowledge about the Turkish Agaricales.

Turkey has a mild and rainy climate. The summers are warm and the winters, cool; nearly all seasons are normally wet with mild temperature. The climate during the spring, summer and autumm is ideal for fungal growth.

MATERIALS AND METHODS

The specimens identified by the authors were collected between 1990 and1994 in Trabzon Province of Turkey. Standard collecting techniques were used. At each collecting site some ecolocigal and morphological properties were noted, and color photographs of the specimens were taken using Zenit 122 camera with a macro objective. Then the specimens were taken to the laboratory and examined microscopically, and some chemical reactions were performed. At the same time spore prints were taken. The materials were dried and identified according to Levetin et al. (1990), Guevara et al. (1985), Hesler (1960), Lincoff (1988), Marchand (1971-1986), Miller (1988), Moser (1983), Phillips (1981), Ramsbottom (1965, 1989), Rayner (1979), Singer (1982), Tulloss (1989, 1990, 1991), Tulloss and Lindgren (1992). The materials examined by the authors are deposited in the Herbarium of Fatih Eğitim (Educatin) Faculty of Karadeniz (Black Sea) Technical University in Trabzon Province of Turkey.

RESULTS AND DISCUSSION

Species preceded by an asterisk (*) are new records for Turkey which were found by the authors and discussed previously (Baydar and Sesli, 1994; Sesli, 1993)

In this study, 329 taxa are listed distributed among families of Agaricales as follows:

Tricholomataceae	34.34 %	Agaricaceae	5.47 %
Boletaceae	10.94 %	Amanitaceae	5.47 %
Cortinariaceae	8.20 %	Lepiotaceae	5.16 %
Coprinaceae	6.99 %	Hygrophoraceae	3.95 %
Strophariaceae	5.47 %	Pleurotaceae	3.34 %

Pluteaceae	2.73 %	Entolomataceae	0.91 %
Bolbitiaceae	2.43 %	Rhodophyllaceae	0.60 %
Crepitotaceae	2.12 %	Gomphidiaceae	0.30 %
Paxillaceae	1.51 %		

Table 1. THE LIST OF THE SPECIES

BOLETACEAE

Boletus aereus Bull.:Fr.
B. aestivalis Fr.
B. calopus Fr.
B. chrysenteron Bull. :Amans
B. edulis Bull.:Fr.
B. elegans Schum.
B. erythropus (Fr.:Fr.) Pers.
B. luridus Schaeff.:Fr.
*__B. porphyrosporus__ Fr.: Hök.
B. queletii Schulzer
B. radicans Pers.:Fr.
B. regius Krombh.
B. retipes Bull.
B. rufus Schaeff.
B. satanoides Smotlacha
B. versicolor Rostk.
*__B. zelleri__ Murr.
Leccinum carpini (R. Schulz.)Moser
L. corsicum (Roll.) Singer
L. insigne (Smith & Thiers)Watling
*__L. oxydabile__ (Sing.) Sing.
L. quercinum (Pilát) Green & Watling
L. scabrum (Bull.:Fr.)S. F.Gray
L. subleucophaeum Dick & Snell
L. versipelle (Fr.)Snell
Suillus bellini (Inz.) Watling
S. boudieri (Quélet) Watling
S. bovinus (L.:Fr.) O. Kuntze
S. granulatus (L.:Fr.)O. Kuntze
*__S. pictus__ (Peck) Smith & Thiers.
S. luteus (L.)S.F.Gray.
S. variegatus (Swartz: Fr.)O.Kuntze
Trachypus pseudoscaber Kallenb.
Tylopilus felleus (Bull. :Fr.)Karst.
Xerocomus badius (Fr.: Fr.)Gilb.
X. subtomentosus (L.) Quel.

GOMPHIDIACEAE

Chroogomphus rutilus (Schaeff.:Fr)O.K.Miller

PAXILLACEAE

Omphalotus olearius (DC.:Fr.)Singer
Paxillus atrotomentosus (Batsch:Fr.)Fr.
P. involutus (Batsch.: Fr.)Fr.
P. panuoides Fr.
P. rhodaxanthus Schw.

PLEUROTACEAE

Pleurotus cornucopiae Paul.:Fr.
P. dryinus (Pers.:Fr.) Kumm.
P. eryngii (D.C.:Fr.) Quél.
P. ilgazicus Pilát
P. nemecii Pilát
P. ostreatus (Jack.:Fr.)Kummer

P. ostreatus var. **salignus** (P.:Fr.)Kummer
P. pubescens (Sow.) Schroet.
P. pulmonarius (Fr.)Quel
P. serotinus var. **flaccidus** Lange
P. ulmarius (Bull.:Fr.) Quél.

COPRINACEAE

Coprinus atramentarius (Bull.:Fr.)Fr.
C. comatus (Müller :Fr.) S.F.Gray
C. disseminatus (Pers.) Fr.
C. galericuliformis Losa :Watling
C. micaceus (Bull.:Fr.) Fr.
C. niveus (Pers.:Fr.)Fr.
C. ovatus Fr.
C. picaceus (Bull.:Fr.) S.F.Gray
C. radiatus (Bolt.)Fr.
Lacrymaria lacrymabunda (Bull.:Fr.)Pat.
L. lacrymabunda var. **velutina** Pers.
Panaeolus acuminatus (Schff.:Secr.)Quél.
P. campanulatus (Bull.: Fr.)Quél.
P. fimicola (Fr.)Quel. Ricken.
P. foenisecii (Pers.: Fr.)Schröter
P. retirugis (Fr.)Quel
Psathyrella candolleana (Fr.)Maire
P. fatua (Fr.)Konr.& Maubl.
P. gracilis (Fr.)Quélet
P. melanthina (Fr.)Kühn. & Romagn.
P. obtusata (Fr.)A.H. Smith
P. prona (Fr.)Gillet
P. spadiceogrisea (Fr.) Maire

PLUTEACEAE

Pluteus atricapillus (Secr.)Sing.
P. cervinus (Schaeff.: Fr.)Kummer
P. minutissimus R. Mre.
P. petasatus (Fr.)Gill.
P. salicinus (Pers.:Fr.) Kummer
P. tomentosulus Pk.
Volvariella bombycina var. **maxima** Pilát.
V. media (Schum.:Fr.) Sing.
V. speciosa (Fr.:Fr)Sing

RHODOPHYLLACEAE

Rhodophyllus lanicus Romagn.
R. sinuatus (Bull.:Fr.) Sing.

ENTOLOMATACEAE

Clitopilus prunulus (Scop.:Fr.)Kummer
Entoloma clypeatum (L. :Fr.)Kummer
E. lividum (Bull.:St. Amans)Quel.

HYGROPHORACEAE

Camarophyllus subradiatus (Schum.)Wünsche
C. virgineus (Wulf.:Fr.) Kars.
Hygrocybe conica (Scop.: Fr.)Kummer
***H. langei** Kühn.
H. nigrescens (Quel.) Kühner
***H. subglobispora** Orton
Hygrophorus calophyllus Karst.
H. chrysodon (Batsch: Fr.)Fr.

H. croceus (Bull.)Bres.
H. eburneus (Bull.:Fr.) Fr.
H. fuscoalbus (Lasch)Fr.
H. pudorinus (Fr.)Fr.
H. russula (Schaeff.:Fr.)Quél.

AMANITACEAE

Amanita vaginata var. alba (De Seynes)Gill.
A. caesarea (Scop.: Fr.) Quel.
A. citrina (Schaeff.) Pers.
A. codinae (R.Maire) Singer
*A. excelsa (Fr.:Fr.) Bertillon
A. gemmata (Fr.)Gill.
A. junquillea Quélet.
A. muscaria (L.:Fr.)Pers.
A. ovoidea (Bull.:Fr.) Link
A. pantherina (DC.:Fr.) Krombh.
A. phalloides Link:Fr.
A. spissa (Fr.)Kummer
A. rubescens Pers.
A. vaginata (Bull.:Fr.) Vitt.
A. valens (E.J.Gilb.) Bertault
A. verna (Bull.:Fr.) Lamarck
A. virosa Lamarck
Torrendia pulchella Bres

AGARICACEAE

*Agaricus arvensis Schaeff.:Secr.
A. augustus Fr.
A. bernardii (Quél.)Sacc
A. bisporus (Lange)Pilat
A. bitorquis Moll.
A. campestris L.:Fr.
A. comtulus Fr.
A. cupreobrunneus (Schff.& Steer:Moell.)Moell.
A. lanipes (Moell. & Schff.)Sing.
A. meleagris J. Schaeff.
A. rodmani Weck
A. semotus Fr.
A. silvicola (Vitt.)Peck
A. xanthodermus Genevier
A. xerampelinus Schaeff.
A. variecolar Pers.
Psalliota edulis var. valida Möller
P. perrara (Schulzer) Bres.

LEPIOTACEAE

Cystoderma amianthinum ([Scop.]Fr.)Fayod
Lepiota acutesquamasa Gill
L. alba (Bres.)Sacc.
L. badhamii (Berk.Br.) Quél.
L. brunneo-incarnata Chod.:Martin
L. cristata Kummer
L. cygnea (Lange.)Mosser
L. holosericea (Fr.)Gill.
L. jubilaei Joss.
L. litoralis (Menier) Boiffard
L. naucina Fr.
L. rhodorrhiza Romagn.& Locq.:P.D.Orton
Leucoagaricus leucothites (Vitt.) Wasser
Macrolepiota excoriata Schaeff.:Fr.
M. mastoidea (Fr.)Singer
M. permixta Barla.
M. procera (Scop.:Fr.) Sing.

BOLBITIACEAE

Agrocybe aegerita (Brig.) Sing.
A. dura (Bolt.:Fr.)Sing.
A. semiorbicularis (Bull.:St.Amans)Fayod

A. pediades (Pers.:Fr.) Fay.
Bolbitius vitellinus (Pers.:Fr.)Fr.
Canocybe lactea (Lange) Metrod
C. coprophila (Kühn.) Kühn.
C. rickeniana Sing.

STROPHARIACEAE

Hypholoma fasciculare (Huds.:Fr.)Kummer
Kuehneromyces mutabilis (Schaeff.:Fr.)Sing & Smith
Naematoloma sublateritium (Fr.)Karst
Pholiota adiposa (Fr.) Kummer
P. astragalina (Fr.) Singer
P. aurivella (Batsch:Fr.)Kummer.
P. caperate (Pers.:Fr.) Kummer
P. destruens (Brond.) Quel.
P. flammans (Fries.) Kummer
P. radicosa (Bull.:Fr.) Kummer
P. spectabilis (Fr.) Kummer
P. squarrosa (Müller:Fr.)Kummer.
P. tuberculosa (Schaeff.:Fr.)Kummer
Psilocybe pratensis P.D. Orton
Stropharia aeruginosa (Curtis:Fr.)Quélet
S. coronilla (Bull.:Fr.) Quel.
S. semiglobata (Batsch.:Fr.)Quel.
S. stercoraria Quél.

TRICHOLOMATACEAE

Armillaria bulbosa (Barla:Kile)Watl.
A. mellea (Vahl.:Fr.) Kummer.
A. tabescens (Scop.:Fr.) Emel
Clitocybe alexandri (Gill)Konr.
C. cyathiformis (Bull.:Fr.)Kummer
C. dealbata (Sow.:Fr.) Kummer.
C. ectypa Fr.
C. familia (Pk.)Sing.
C. fragrans (With.:Fr.) Kummer
C. geotropa (Bull.:Merat)Quél.
C. gibba (Pers.:Fr.)Quel.
C. gigantea (Sow.:Fr.) Quel.
C. infundibuliformis (Schaeff.:Weinm.)Quél.
C. inversa (Scop.:Fr.) Quel.
C. laccata (Scop.:Fr.) Kummer
C. lignatilis (Pers.:Fr.)Kummer
C. perilis Gill
C. nebularis (Batsch:Fr.)Kummer
C. odora (Bull.:Fr.) Kummer
C. paropsis (Fries)Quel. &Bres.
C. radicellata Gillet
C. rhizophora (Vel.) Josserand:Pouchet
C. squamulosa (Pers.:Fr.)Lange
C. tabascens (Scop.)Bres.
Collybia butyracea (Fr.:Fr)Kummer
C. cessans Karst
C. dryophila (Bull.:Fr.) Kummer

C. fusco-purpurea (Pers.:Fr.)Kummer
C. grammocephala (Bull.) Fr
C. longipes (Bull.:St. Amans)Mos.
C. peronata (Bolt.:Fr.) Sing.
C. tuberosa (Bull.:Fr.) Kummer
Flammula hybrida (Fr.:Fr)Gillet
F. liquiritiae Persoon.
F. penetrans (Fr.:Fr.) Quel.
F. sapinea Quél.
F. spumosa (Fr.)Fr.
F. velutipes (Curt.:Fr.) Karst.
Hohenbuehelia atrocoerulea (Fr.:Fr.) Sing.
H. rickenii (Kühner) Orton
Laccaria amethystina Cke.
L. laccata (Scop.:Fr.) Berk & Br.
Lepista luscina (Fr.:Fr.)Sing.
L. nuda (Bull.:Fr.)Cooke
L. saeva (Fr.)Orton
L. sordida (Fr.)Singer
Leucopaxillus amarus (Alb.:Schw.:Fr.)Kühn.
L. cerealis (Lasch)Sing.
L. gentianeus (Quél)Kotl.
Marasmius androsaceus (L:Fr.)Fr.
M. calopus (Pers.:Fr.) Fr.
M. caryophylleus (Schaeffer)Schroet.
M. oreades (Bolt.:Fr)Fr.
M. perforans Hoffm.
M. ramealis (Bull.:Fr.)Fr.
M. resinosus Peck.
M. rotula (Scop.:Fr.)Fr.
M. splachnoides Fr.
Micromphale brassicolens (Romagn.)Orton
Melanoleuca cinerascens Reid
M. cognata (Fr.:Kon.) Maubl. & Lge.
Mycena alcalina Kühn.
M. atroalba (Bolt.:Fr.) Gill.
M. corticola (Pers.:Fr.) Quél.
M. epipterygia Bres.
M. fibula (Bull.:Fr.) Kumm.
M. filopes (Bull.:Fr.) Quél.
M. galericulata (Scop.:Fr.)Gray
M. inclinata (Fr.)Quél.
M. integrella (Pers.:Fr.)S.F.Gray
M. niveipes Murr.
M. parabolica Fr.
M. plicosa (Fries.) Kummer
M. polygramma (Bull.)Fr. forma pumila
*M. pseudocorticola Kühn
M. pura (Pers.)Fr. forma rosea
M. sanguinolenta (Alb.& Schw.:Fr.)Kummer
M. speirea (Fr.)Gill
M. stylobates (Pers.:Fr.)Kumm.
M. strobilicola Favre & Kühner
M. subincarnata (Peck) Sacc.
M. tintinnabulum (Fr.) Quél.
M. vulgaris (Pers.:Fr.) Quel.
Omphalina abiegna (Bk.& Br.)Sing.
O. gracillima (Weinm.) Fries
O.hepatica(Fr.:Fr.)Gill.

O. hydrogramma (Bull.: Fr.)Quel.
O. leucophylla Fr.
O. velutina Quél.
O. olearius (D.C.:Fr.) Sing.
Oudemansiella mucida (Schrad.:Fr.)Hoehn.
O. radicata (Rehl.:Fr) Sing.
Panellus mitis (Pers.: Fr.)Sing.
P. stypticus (Bull.:Fr.) Karst.
Xeromphalina campanella (Batsch:Fr.)Mre.
Rhodocybe mundula (Lasch) Sing.
R. truncata (Schaeff.: Fr.)Sing.
Strobilurus stephanocystis (Hora) Sing.
Tricholoma albobrunneum Heim
T. aurantium (Schaeffer: Fr)Rick.
T. auratum (Paul.:Fr.) Gillet
T. batschii Gulden
T. caligatum (Viv.) Ricken
T. flavovirens (Pers.: Fr.)Lund & Nanf.
T. grammopodium (Bull.) Fr.
T. melaleucum Quél
T. orirubens Quél.
T. populinum Lge.
T. rutilans (Schaeffer.: Fr.)Sing.
*T. sejunctum (Sow.:Fr.) Quel.
T. sordidum (Fr.)Kummer
T. terreum (Schaeff.: Fr.)Kummer
T. virgatum (Fr.:Fr.) Kumm.

CREPIDOTACEAE

Crepidotus cesatii Rab.
C. mollis (Schaeff.:Fr.) Kummer
C. pubescens Bres.
*C. sphaerosporus (Pat.) Lge.
Tubaria furfuracea (Pers.:Fr.)Gill.
T. pellucida Bull.
T. trigonophylla (Lasch) Fayod

CORTINARIACEAE

*Cortinarius auroturbinatus (Secr.) Lange.
*C. bulbosus (Fr.)Rick.
*C. bulliardii (Fr.)Fr.
C. cotoneus Fr.
C. malachioides P.D. Orton
*C. glaucopus (Schff.: Fr.)Fr.
C. olivaceo-fuscus Kuehn.
C. punctatus (Pers.) Fr.
C. purpurascens Fr.
*C. subturbinatus Henry.
C. subvalidus R. Henry
Hebeloma leucosarx Orton
H. populinum Romagn.
H. sinapizans (Paulet: Fr.)Gillet
Galerina marginata (Fr.) Kuehn.
G. unicolor (Fr.)Sing.
Inocybe fastigiata (Schaeff.:Fr.)Quél.
I. fibrosa var. trivialis Lge.
I. geophylla var. lilacina Gillet
I. gymnocarpa Kühn.
I. patouillardii Bres.
I. perbrevis (Weinm.) Gill.
I. subrubens Atkinson.

I. xanthodermus Boursier & Kühn.

Naucoria abstrusa (Fr.) Fr.

Phlegmacium amoenolens R. Hry.

P. variecolar (Fr.) Wünsche

ACKNOWLEDGMENT

The authors wish to thank Rodham E. Tulloss for the identification of some species of Amanita and reviewing the manuscript before publication.

LITERATURE CITED

Asan, A. and F. Gücin. 1990. Istıranca dağlarında (Trakya) belirlenen bazı makrofunguslar. X. **Ulusal Biyoloji Kongresi** 1: 155-162.

Baydar, S. and E. Sesli. 1994. Trabzon ili Akçaabat yöresinde belirlenen makromantarlar. **Doğa-Tr. J. Bot.** 18: 99-101.

Demirel, K. and M. Işıloğlu. 1993. Ardanuç (Artvin) yöresi makrofungusları. **Yüzüncü Yıl Üniversitesi Fen Edebiyat Fakültesi Fen Bilimleri Dergisi** 4: 49-57.

Guevara, G., I. Garcia and J. Castillo. 1985. Algunos Agaricales del norte de Mexico. **Rev. Mex. Micol.** 1: 129-188.

Gücin, F. and M. Öner. 1982. Manisa ili dahilinde yetişen makrofunguslar. **Doğa Bilim Dergisi: Temel Bilimler** 6 (3): 91-96.

Gücin, F. 1987. Macrofungi of Pütürge (Malatya) in eastern Anatolia. **Fırat University** 2 (1): 19-26.

Gücin, F. 1990. Elazığ çevresinde belirlenen makrofunguslar. **Doğa-Tr. J. Bot.** 14: 171-177.

Hesler, R.L. 1960. **Mushrooms of the great smokies.** Kingsport Press. Inc., U.S.A.

Işıloğlu, M. and R. Watling. 1992. Macromycetes of Mediterranean Turkey. **Edinb. J. Bot.** 49 (1): 99-121.

Karamanoğlu, K. and N. Öder. 1973. Bursa ili ve çevresinde yetişen bazı şapkalı mantarlar. **Ankara Üniversitesi Ecz. Fak. Mec.** 3 (13): 13-33.

Kotlaba, F. 1976. Contribution to the knowledge of the Turkish macromycetes. **Ceska Mycol.** 30: 3-4.

Levetin, E., N. Jones, and K. Owens. 1990. A preliminary checklist of the Agaricales of Tulsa County, Oklahoma. **Mycotaxon** 36 (2): 337-342.

Lincoff, H. G. L. 1988. **The Audubon Society field guide to North American mushrooms.** Fourth Edition. Chanticleer Press. Inc., New York.

Lohwag, K. 1957. Türkiye'nin mantar florası hakkında araştırma. **İ.Ü. Orman Fakültesi Dergisi** 7 (1): 128-137.

Lohwag, K. 1964. Belgrad ormanından mikolojik notlar. **İ.Ü. Orman Fakültesi Dergisi** 14 (2): 128-135.

Marchand, A. 1971-1986. **Champignons du Nord et du** mıdı. tomes 1-9. Perpignan.

Miller, O.K. 1988. **Mushrooms of north America.** Milton Rugoff Dai Nippon Printing Co., Tokyo.

Moser, M. 1983. **Keys to agarics and boleti (Polyporales, Boletales, Agaricales, Russulales).** London.

Öder, N. 1982. Kastamonu çevresinde yetişen bazı şapkalı mantarlar. S. Ü. **Fen Fakültesi Dergisi** 2: 39-48.

Öder, N. 1986. Karadeniz bölgesinde (Sinop-Artvin illeri arası) yetişen önemli bazı zehirli mantarlar üzerinde taksonomik araştırmalar. S. Ü. **Fen Edebiyat Fakültesi Fen Dergisi** 5: 87-104.

Öder, N. 1988. Karadeniz bölgesinde (Sinop-Artvin illeri arası) yetişen, halkın tanıdığı bazı önemli yenen mantarlar üzerine taksonomik araştırmalar. S.Ü. **Fen Edebiyat Fakültesi Fen Dergisi** 8: 215-236.

Öner, M. 1972. A contribution to the knowledge of common Turkish higher fungi. **Mycopathologia et Mycologia applicata** 47 (4): 369-373.

Öztürk, A., İ. H. Arık and K. Demirel. 1990. İnegöl (Bursa) çevresinde yetişen zehirli ve yenen mantarlar üzerinde sistematik, morfolojik ve ekolojik incelemeler. **Yüzüncü Yıl Üniversitesi Fen Edebiyat Fakültesi Fen** Bilimleri Dergisi 1 (1): 27-38.

Phillips, R. 1981. **Mushrooms and other fungi of Great Britain and Europe.** First Edition. New Interlitho S.P.A. Milan.

Pilát, A. 1932. Contribution á l'étude des hymenomycetes de l'Asie Mineure. **Bull. Soc. Mycol. France** 48: 162-189.

Pilát, A. 1933. Additamenta ad floram Asiae Minoris hymenomycetum. Pars secunda: Agaricineae. **Bull. Soc. Mycol France** 49: 283-302.

Ramsbottom, J. 1989. **Mushrooms and toadstools.** William Collins Sons & Co. Ltd. Nineth edition. London.

Ramsbottom, J. 1965. **A handbook of the larger British fungi**. seventh Reprint. Alden Press. Oxford.

Rayner, R. 1979. **Mushrooms and toadstools.** Hamlyn Publishing Group Limited. Italy.

Selik, M. 1965. Belgrad ormanında bulunan yenilebilen mantarlar. **İ.Ü. Orman Fakültesi Dergisi** 15 (2): 48-55.

Selik, M. and S. Aksu. 1967. İstanbul'un park ve korularındaki yerli ve yabancı ağaç türlerine arız olan odun tahrip eden mantarlar. **İ.Ü. Orman Fakültesi Dergisi** 17 (1): 90-101.

Sesli, E. 1993. Trabzon ili Maçka yöresi makrofungusları. **Doğa-Tr. J. Bot.** 17:179-182.

Singer, R. 1962. **The Agaricales in modern taxonomy**. Second Edition. Chr. Belser of Stuttgart. Germany.

Sümer, S. 1989. Some new records for the fungal flora of Turkey. **Marmara Üniversitesi Fen Bilimleri Dergisi** 6: 1-22.

Solak, M. H. and F. Gücin. 1990. Bursa yöresinden bazı makrofunguslar. **X. Ulusal Biyoloji Kongresi** 1: 163-171.

Solak, M. H. and Gücin, F. 1992. Bursa Yöresinden Türkiye İçin Yeni Makrofungus Türleri ve Yörede Belirlenen Diğer Makrofunguslar. **Doğa-Tr. J. Bot.** 16: 335-346.

Tulloss, R. E. 1989. Amanita eburnea - A new species from Central America. **Mycotaxon** 36:1-7.

Tulloss, R. E. 1990. Amanita crenulata - history, taxonomy, distribution, and poisonings. **Mycotaxon** 39: 393-405.

Tulloss, R. E. 1991. Amanita morrisii - history, taxonomy, and distribution.**Mycotaxon** 40:281-286

Tulloss, R. E and J. E. Lindgren. 1992. Amanita smithiana-taxonomy, distribution, and poisonings. **Mycotaxon** 45: 373-387.

Watling, R. and M. N. Gregory. 1977. Larger fungi from Turkey, Iran and neighbouring countries. Karstenia 17: 59-72.

MYCOTAXON

Volume LX, pp. 225-240 October-December 1996

A NEW SPECIES OF *THERMOASCUS* WITH A *PAECILOMYCES* ANAMORPH AND OTHER THERMOPHILIC *THERMOASCUS* SPECIES FROM TAIWAN

Kuei-Yu Chen* and Zuei-Ching Chen**

*Associate Professor, Department of Biology,
Chinese Culture University, Taipei, Taiwan, R.O.C.
**Professor, Department of Botany, National Taiwan
University, Taipei, Taiwan, R.O.C.

Abstract

A new thermophilic ascomycete isolated from field soils of Taiwan, *Thermoascus taitungiacus* sp. nov. with a *Paecilomyces* anamorph is described and illustrated. It is characterized by the presence of predominantly echinulate ascospores under LM, but appearing irregularly verrucose under SEM. The temperature range for mycelial growth was between 25°C-50°C. Abundant conidia and ascomata were produced at the optimum growth temperature of 40°C and 30-35°C, respectively. No growth occurred at 20 °C. Some other species of *Thermoascus* from Taiwan are also discussed.

Key words: *Thermoascus taitungiacus*, *Paecilomyces*, thermophilic *fungi*, *Thermoascus*, soil fungi, Ascomycotina.

Introduction

During a survey of thermophilic fungi in Taiwan, three species belonging to the genus *Thermoascus* were isolated from field soils. One of them different from the known species is proposed as a new species. All dried culture specimens and living cultures are deposited in the Mycological laboratory, Department of Botany, National Taiwan University (TAI-Mycology). Capitalized color names are those in Ridgway (1912).

Result and Discussion

Three species of thermophilic *Thermoascus* from Taiwan, i.e., *Thermoascus aurantiacus* Miehe, *T. crustaceus* (Apinis & Chesters) Stolk and a new species, *T. taitungiacus* having *Paecilomyces* anamorph are described as follows:

1. ***Thermoascus taitungiacus*** K. Y. Chen & Z. C. Chen sp. nov.

Fig. 1-3.

Coloniae in agaro " YpSs ", crescola totus catillus ad 40°C post six dies. et aerius et decumbens hyphae, abundans agamicus structura cum maxime efficiens aerius hyphae ac pauci granulae disseminatus. Collor albesco ad Naples Yellow (Ridgway, 1912); reversum armeniacus flaius cum aurantiacus flavus granulae.

Ascocarpae non ostiolatae, dispersae vel confluentes, subglobosae vel irregulares, 330-600 μm diam., flavae, aurantiacae vel brunneolae. Asci glabri, hyalini, globosi vel subglobosi, octospori, (8.5) 10-13 x 10-15 μm. Ascosporae galbanae, ovoideae vel ellipsoideae, globosae vel subglobosae, 4.5-5.6 x 6.3-7.5 μm, crassitunicatae, spinulosae.

Anam: *Paecilomyces taitungiacus* K. Y. Chen & Z.C. Chen sp. nov.

Conidiophora recta, hyalina, septata, glabra, phialides hyalina, cylindrica vel ampullacea (2.8) 3.4-5.6 x 18-32 μm, singulares vel irregulariter 2-3 verticillatae. Conidia laevia, flavida, elliptica, (3-5 x 5-8 μm), vel subglobosa (2.5-6 μm diam).

Holotypus: Colonia exsiccata ex K-Y Chen 8709-2 (TAI-Mycology), ver solum in " Antong " Taitung, Taiwan, 5.IX.1987.

Etymology: *taitungiacus*, referring to Taitung, the locality where this new species was isolated in Taiwan.

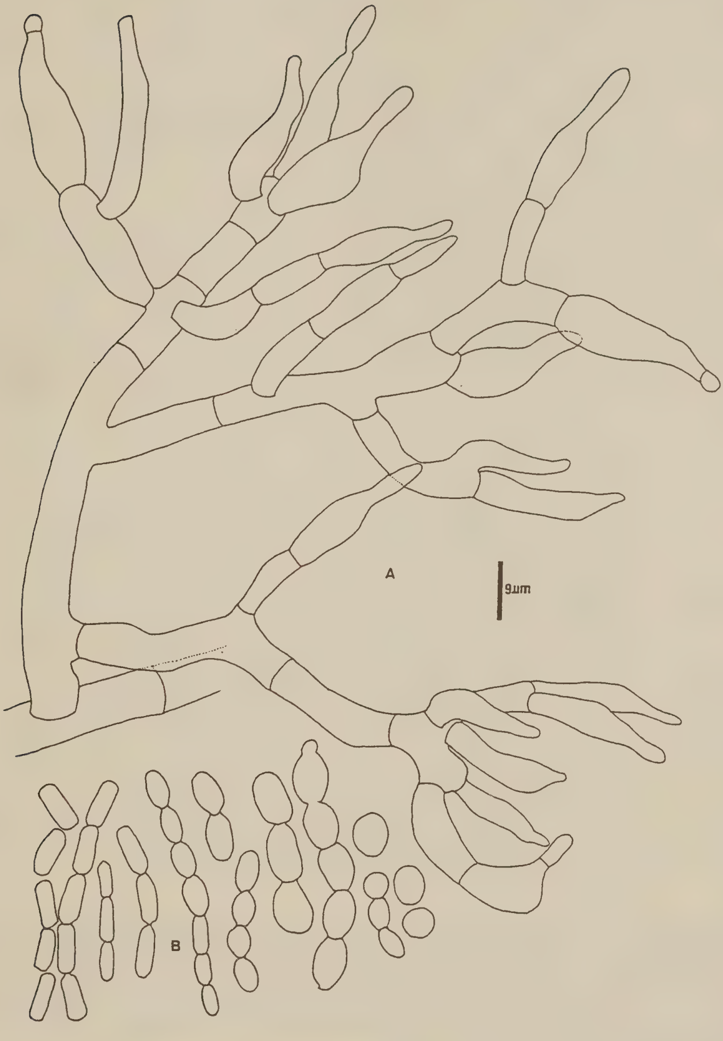


Fig. 1. ***Paecilomyces taitungiacus*** sp. nov. (Chen 8709-2).
A. Conidiophore and phialides. B. Conidia.

Colonies on YpSs, growing all plate at 40°C in 6 days, both aerial and prostrate hyphae abundant, asexual reproductive structures mostly coming from aerial hyphae, mycelial granules scattered, White at first becoming Naples Yellow, reverse Apricot Yellow with orange yellow granules. At 35°C, colonies with abundant granules, covered by sparse, erect aerial hyphae; the color Naples Yellow-Mustard Yellow, Cadmium Yellow, then turning to Light Orange Yellow, reverse Cadmium Yellow with Orange Rufous granules.

Ascomata nonostiolate, scattered or confluent, forming a crust-like layer, covered by aerial hyphae and conidia, subglobose, or irregular in shape, 330-600 μm in diam., white at first, then yellow, light orange yellow, orange, orange brown. Asci smooth, hyaline, globose or subglobose mostly with 8 ascospores (sometimes with 4-6 ascospores) (8.5) 10-13 x 10-15 μm evanescent at maturity. Ascospores yellowish green, oval to elliptical, rarely globose to subglobose, 4.5-5.6 x 6.3-7.5 μm, thick-walled, predominantly echinulate under LM, but irregularly verrucose under SEM.

Conidiophores erect, arising from prostrate and trailing aerial hyphae, hyaline, septate, smooth walled, consisting of an irregularly arranged branch system, and with the apex of each branch bearing 1-3 phialides. Phialides usually cylindrical or slightly flask-like, (2.8) 3.4-5.6 x 18-32 μm, with a long conidium-bearing neck, up to 8 μm long , single as side branches or appearing irregularly 2 or 3 at the end of branches. Conidia in long chains at the tip of phialides, smooth, pale yellow, cylindrical at first (2.2.-3.4 x 4.0-7.0 μm), then elliptical (3.0-5.5 x 5-8.0 μm) or subglobose (2.5-6.0 μm in diam.) at maturity.

Specimen examined: **TAIWAN**: Taitung, Antong. low land, weed soils, 5 IX, 1987. K-Y Chen 8709-2 (Holotype, TAI-Mycology).

Temperature tests: It is a thermophilic fungus. The optimum temperature for mycelial growth was between 30°C and 40°C. The most abundant production of conidia was observed at 40°C, followed at 30°C and 35°C, but ascocarp production was abundant between 30°C and 35°C and very sparse at 40°C.

Note: The genus *Thermoascus* was established by Miehe in 1907.

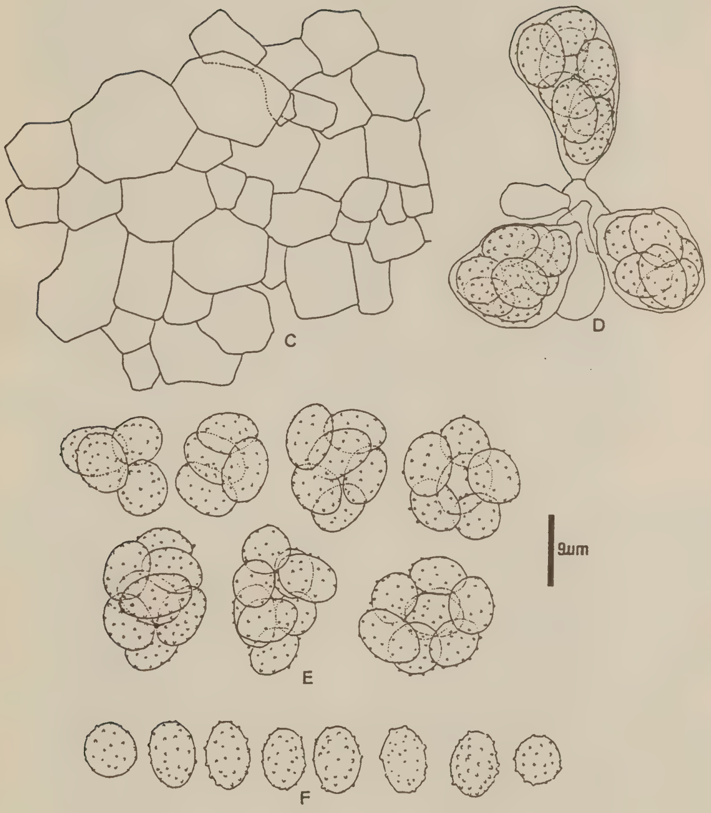


Fig. 2. ***Thermoascus taitungiacus*** sp. nov. (Chen 8709-2).
C. A portion of ascomal peridium. D. Asci. E. Ascospores in evanescent asci. F. Ascospores.

Table 1. Radial growth, conidium and ascoma formation of *Thermoascus taitungiacus* (Chen 8709-2) on YpSs medium at various temperatures.

Temperature	Mycelial growth			Conidia	Ascomata
℃	3d	6d	9d	6d	6d
20	0	0	0	-	-
25	0	22	32	+	-
30	43	71	full	++	++++
35	71	full*	full	+++	+++
40	79	full	full	++++	+
50	18	32	36	-	-

*: Diameter of petri dish: 85mm

Growth: Colony diameter (mm) after 3, 6, 9 days (d).

Conidia and ascomata : (++++) very abundant; (+++) abundant; (+) moderate; (+) slight and (-) not produced.

Several species of *Thermoascus* are thermophilic, including *T. aurantiacus* (Miehe, 1907) ; *T. aurantiacus* var. *levisporus* Upadhyay, Farmelo, Goetz & Melan (1984) ; *T. crustaceus* (Stolk, 1965); *T. thermophilus* (Sopp) von Arx (1970) and *T. aegyptiacus* Ueda & Udagawa (1983). The taxonomy of these fungi is based mainly on the morphology of their anamorph and teleomorph.

Thermoascus aurantiacus was first isolated by Miehe (1907), followed by Apinis (1967). It was isolated from alluvial grassland soils. Tansey (1973) also isolated it from alligator nesting material. They had similar anamorph-aleurioconidia (a single, thick-walled, terminal conidium); while no conidia were observed from those isolated by Awao & Otsuka (1973); Minoura, et al.(1973); Stolk (1965) and Chen & Chen (1988). Cooney & Emerson's isolate of *T. aurantiacus* is most likely identical with *T. crustaceus* (Stolk, 1965). Upadhay, et al. (1984) reported a new variety, *T. aurantiacus* var. *levisporus*, which had an anamorph similar to that of *T. aurantiacus*. The anamorph of *T. crustaceus* (Stolk, 1965) (=*Dactylomyces crustaceus* Apinis & Chesters, 1967) and *T. aegyptiacus* (Udea & Udagawa, 1983) were confirmed to be the *Paecilomyces*, while *T. thermophilus* produced a *Polypaecilum* anamorph. All species of *Thermoascus* had ellipsoidal

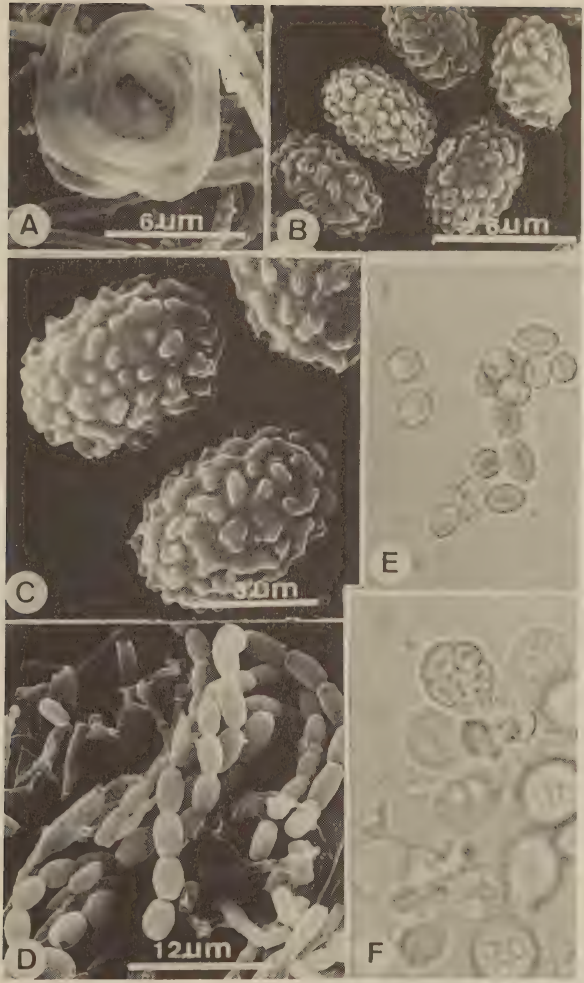

A
6µm
B
6µm
C
3µm
E
D
12µm
F

Fig. 3. ***Thermoascus taitungiacus*** sp. nov. (Chen 8709-2). A. Ascomal initials. B & C. Ascospores. D. Conidia. E. Ascospores (x 1250). F. Asci (x 1250). (A-D. Under SEM; E-F. Under LM).

and nearly smooth ascospores under LM. Under SEM, however the ascospores appeared very minutely verrucose in *T. aurantiacus* , finely echinulate in *T. crustaceus*, and verruculose in *T. thermophilus* and *T. aegyptiacus*. The ascospores of *T. taitungiacus* were not only predominantly echinulate under LM, but also irregularly verrucose under SEM. It showed close affinity to *T. crustaceus* in having a *Paecilomyces* anamorph. Two kinds of conidia were observed in the new species, one cylindrical or elliptical and the other globose to subglobose. The latter usually developed at maturity.

2. ***Thermoascus aurantiacus*** Miehe, Die Selbsterhitzung des Heues, p.70-73 (1907).

Fig. 4-5.

Colonies on PDA growing very rapidly, covering the plate at 40℃ in 3 days, with erect white hyphae and granule-like ascomata, reverse Dark Mars Brown.

Ascomata single or in groups forming a crust, first white, then turning to yellow, orange, orange brown and dark liver brown, subglobose, ovoid or irregular in shape, 280-560 x 370-672 μm. Asci globose, subglobose or ovoid, 8-11 x 10.6-14 μm with 4-8 ascospores irregularly arranged. Acospores elliptical, slightly roughened, 4-4.2 x 4.2-7 μm. No asexual structure has been observed in our isolates.

Specimen examined: **TAIWAN**: Taipei, Tangsui Cheng, low land cultivated soil of turnips. 20. Ⅳ .1984. K-Y Chen 8404-4. Pingtung Hsien, Kueilai Hsiang, low land paddy soil, 10.VIII.1986. K-Y Chen 8608-28.

Temperature tests: Growth was very fast at 40℃ and 50℃. No growth occured at 30℃ in 6 days. Ascomata were produced very abundantly at 40℃ and 50℃.

Note: Although Cooney & Emerson(1964) described the conidial structure of *T. aurantiacus* as *Paecilomyces*-like, no asexual structure has been observed in our isolates. Other morphological characters of our isolates are identical to the descriptions of this species reported by Awo and Otsuka (1973).

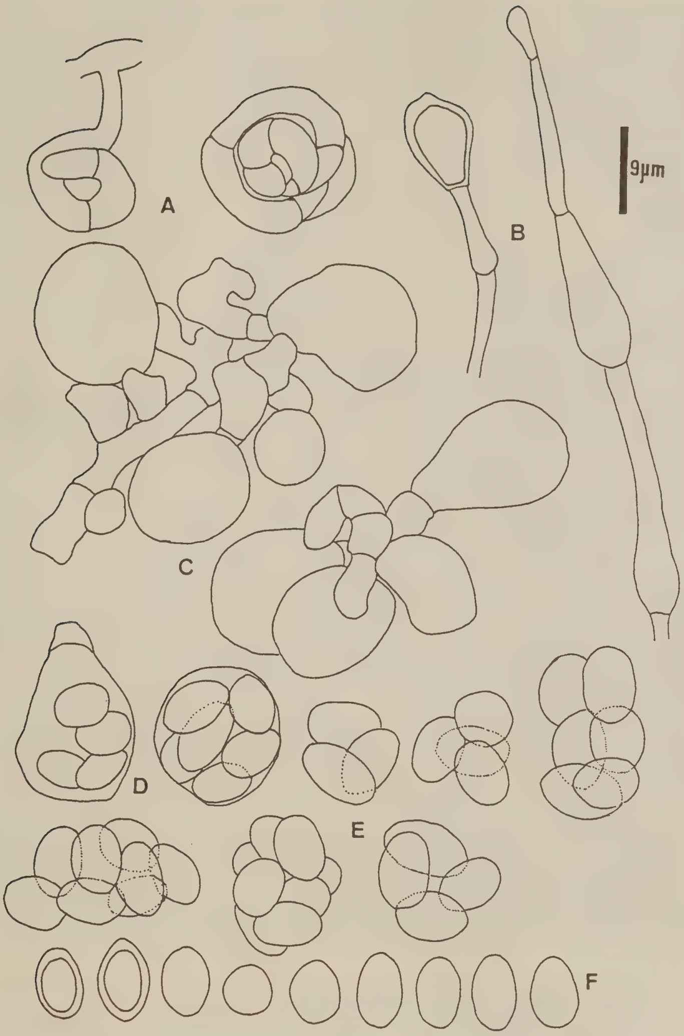


Fig. 4. ***Thermoascus aurantiacus*** (Chen 8404-4).
A. Ascomal initial. B. Hyphae swollen near septum. C. Ascogenous cells. D. Asci with ascospores. E. Ascospores in evanescent asci. F. Ascospores.

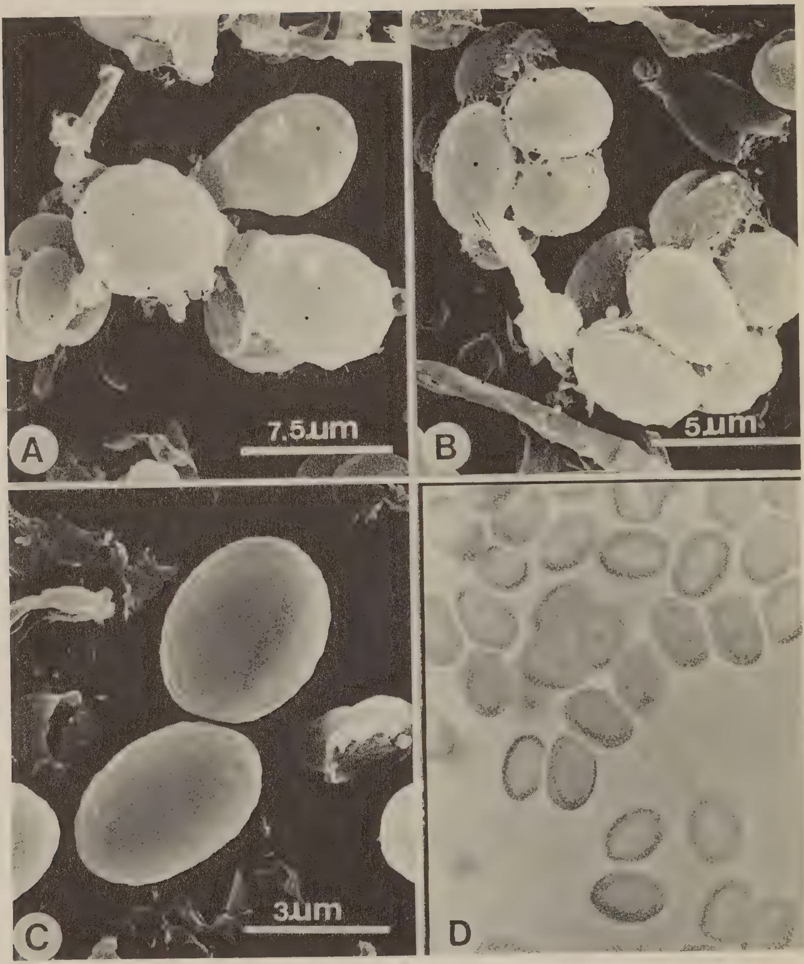

7.5µm
A
5µm
B
3µm
C
D

Fig. 5. ***Thermoascus aurantiacus*** (Chen 8404-4).
A. Asci. B. Ascospores in evanescent asci. C. Ascospores. D. Ascospores (x 1250). (A-C. Under SEM; D. Under LM).

Table 2. Radial growth and ascoma formation of *Thermoascus aurantiacus* (Chen 8404-4) on PDA medium at various temperatures.

Temperature	Mycelial growth			Ascomata	
°C	3d	6d	9d	6d	9d
16	0	0	0	-	-
20	0	0	0	-	-
30	0	0	0	-	-
40	full*	full	full	+++	++++
50	full	full	full	+++	++++

*:Diameter of petri dish: (92mm).
Growth: Colony diameter (mm) after 3, 6, 9 days (d).
Ascomata: (++++) very abundant; (+++) abundant; (++) moderate; (+) slight and (-) not produced.

3. ***Thermoascus crustaceus*** (Apinis & Chesters) Stolk, Antonie van Leeuwenhoek, 31: 272 (1965).

Anam: *Paecilomyces crustaceus* Apinis & Chesters, Trans. Br. mycol. Soc. 47: 429 (1964).

Fig. 6-8.

Colonies on YpSs, growing very well, attaining all plate at 40°C in 3 days, bearing prostrate and aerial hyphae, granules scattered, covered by erect hyphae, sometimes forming sectors. The color was white at first, Antimony Yellow to Cadmium Orange; reverse Orange Chrome to Orange Rufous. At 35 °C, aerial mycelium sparse and granules more abundant than those of 40°C.

Ascomata originating from ascogonial coils, nonostiolate, scattered to confluent, mostly confluent forming a crusty layer, covered by aerial hyphae.

Ascomata globose to irregular in shape 200-400 x 280-500 μm. Color white at first, Yellow, Yellow orange, reddish orange. Ascomal wall consisting of a few layers of pale yellowish brown pseudoparenchyma cells. Asci single, hyaline, mostly 8-spored, subglobose to pyriform, 11.5-12.5 x 13-16 μm, thin-walled, evanescent at maturity. Ascospores pale yellowish green, mostly elliptical, 4.5-5.1

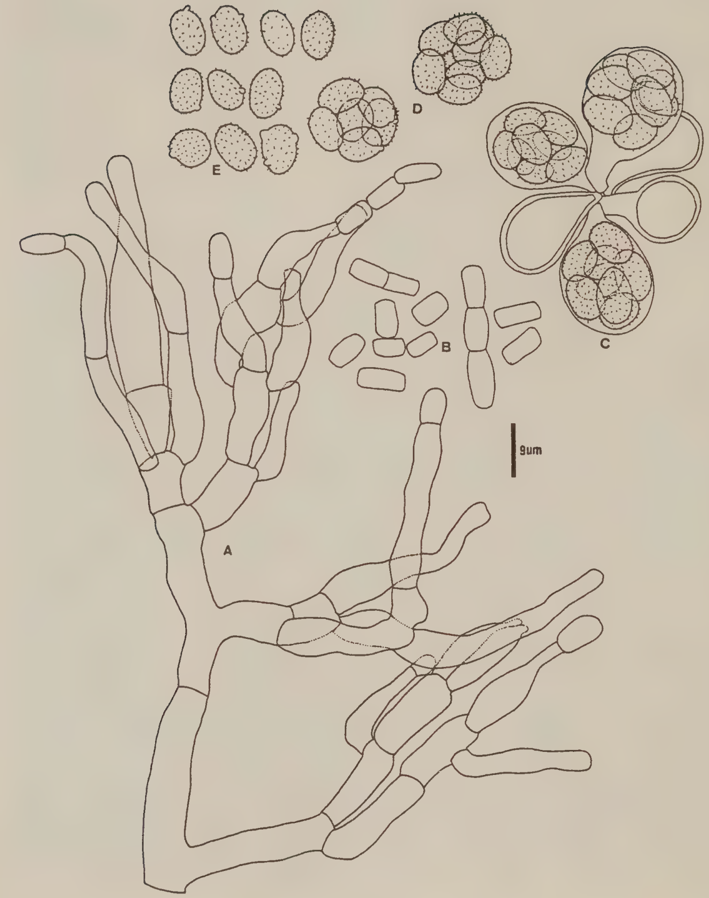


Fig 6. ***Thermoascus crustaceus*** (Chen 8504-10).
A. Conidiophore and phialides. B. Conidia. C. Asci. D. Ascospores in evanescent asci. E. Ascospores.

x 6.0-7.5 µm, rarely globose to subglobose, 4.5-5 µm in diam., the surface with fine echinulations and some spores with 1-3 warty structures.

Conidiophores septate, hyaline to pale yellow, smooth, arising from prostrate and aerial hyphae, irregularly branched on the upper part of conidiophores, measuring 3.5-5.5 x 6.8-36 µm, the apex of each branch bearing phialides with a long conidium-bearing neck. Phialides 4.5-6 x 14.5-30 µm, either solitary or in irregular verticils of 2 or 3 at the tip of branches. Conidia smooth, pale yellow, at first cylindric, then elliptical, measuring 2.5-4.5 x 5-8.5 µm, or sometimes becoming globose or subglobose, 4.5-5 µm. in diam.

Specimen examined: **TAIWAN**: Yunlin Hsien, Yunlin, low land cultivated soils of peanut, 4.Ⅳ.1985. K-Y Chen 8504-10.

Temperature tests: The optimum growth temperature was between 30 ℃ and 40℃. Ascomata were very abundant between 35℃ and 40℃, abundant at 30℃. Asexual structures were very abundant at 30℃, abundant at 35℃ and 40℃.

Table 3. Radial growth, conidium and ascoma formation of *Thermoascus crustaceus* (Chen 8504-10) on YpSs medium at various temperatures.

Temperature	Mycelial growth			Conidia	Ascomata
℃	3d	6d	9d	6d	6d
16	0	0	0	-	-
20	0	20	24	-	-
25	17	48	69	-	+
30	60	83	full	+++	++
35	84	full*	full	++	+++
40	83	full	full	++	+++
50	12	30	37	-	-

*: Diameter of petri dish : 85mm

Growth: Colony diameter (mm) after 3, 6, 9 days (d).

Conidia and ascomata: (++++) very abundant; (+++) abundant; (++) moderate; (+) slight and (-) not produced.

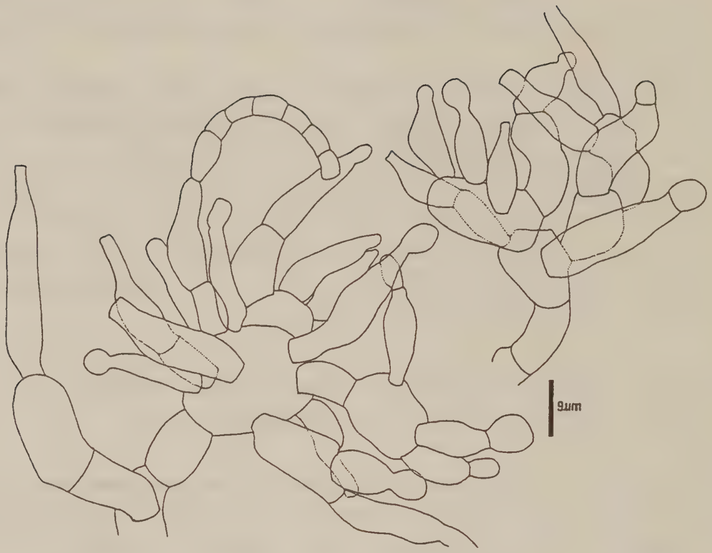


Fig 7. ***Thermoascus crustaceus*** (Chen 8504-10).
Swollen branches bearing phialides, from culture at 40°C.

Note: Variations in phialide-bearing branches occurred at 40°C, including: (1) the width of the upper part of branches swelling up from 3.5-5.5 µm at 30°C to 12 µm (6-12 µm) at 40°C (fig. 7) ; (2) the number of phialides at the end of branches, increased up to 8 or more at 40°C, from 2 to 3 at 30°C; (3) mature conidia varied from elliptical at 30°C to globose at 40°C and (4) phialides becoming shorter at higher temperature, i.e., from 14.5-30 µm at 30°C to 6-12 µm at 40°C. The swelling of phialide-bearing branches at 40°C in our isolates was also recorded for *T. aegyptiacus* by Ueda & Udagawa (1983). The effect of temperature on size of phialides was not mentioned by Stolk (1965). However, this feature of the present isolate appear to be similiar to Stolk's isolate (1965) at 30°C-35°C and to Awao and Mistugi's isolate (1973) at 40°C.

Acknowledgements

The authors are thankful to Drs. C. V. Subramanian and C. J. K. Wang for reviewing this manuscript. This work was partly supported by

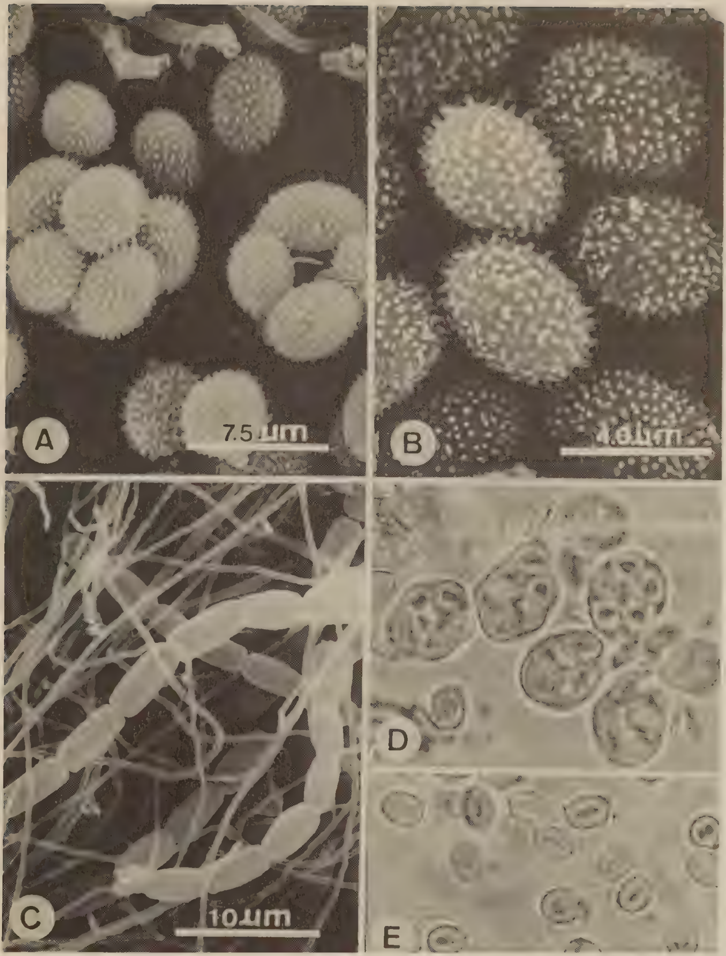

A
7.5 µm
B
4.6 µm
C
10 µm
D
E

Fig 8. ***Thermoascus crustaceus*** (Chen 8504-10).
A. Ascospores in evanescent asci. B. Ascospores. C. Conidia. D. Asci (x 1250). E. Ascospores (x 1250). (A-C. Under SEM; D-E. Under LM)

grants NSC 77-0211-B-002-01 and NSC 77-0606-B-002-167 to Z.C.C. The technical assistances offered by the staffs of Electron Microscope Laboratory, Department of Botany, NTU, are gratefully acknowledged.

Literature cited

Apins, A. E. 1967. *Dactylomyces* and *Thermoascus*. Trans. Br. mycol. Soc. 50: 573-582.

Arx, J. A. von. 1970. The genera of fungi sporulating in pure culture. J. Cramer, Lehre, p 84.

Awao, T. and K. Mitsugi. 1973. Notes on thermophilic fungi in Japan (1). Trans. mycol. Soc. Japan 14: 145-160.

Awao, T. and S. Otsuka. 1973. Notes on thermophilic fungi in Japan (2). Trans. mycol. Soc. Japan 14: 221-236.

Chen, G. Y. and Z. C. Chen. 1988. Thermophilic and Thermotolerant fungi in Taiwan (I). Trans. mycol. Soc. R.O.C. 3 (1): 1-72.

Cooney, D. G. and R. Emerson. 1964. Thermophilic fungi. W. H. Freeman, San Francisco, 188 p.

Miehe, H. 1907. Die Selbsterhitzung des Heus. Eine biologische Studie. Gustav Fischer, Jena. s. 127.

Minoura, K., K. Ochi and T. Nehira. 1973. Thermophilic filamentous fungi in Japan (2). Trans. mycol. Soc. Japan 14: 362 -366.

Stolk, A. C. 1965. Thermophilic species of *Talaromyces* Benjamin & *Thermoascus* Miehe. Antonie van Leeuwenhoek 31: 262-276.

Tansey, M. R. 1973, Isolation of thermophilic fungi from alligator nesting material. Mycologia 65: 594-601.

Ridgway, R. D., 1912. Color standards and color nomenclature. Publ. by the author. Washington, D. C. 43 pp. 53 pl.

Ueda, S. and S. I. Udagawa. 1983. *Thermoascus aegyptiacus,* a new thermophilic Ascomycete. Trans. mycol. Soc. Japan 24: 135-142.

Upadhyay, J. M., M. S. Framelo, S. O. Goetz and M. A. Melan. 1984. A new variety of a thermophilic mold, *Thermoascus aurantiacus var. levisporus.* Mycopathology 87: 71-80.

MYCOTAXON

Volume LX, pp. 241-247 October-December 1996

THIELAVIA PINGTUNGIA SP. NOV. A THERMOPHILIC ASCOMYCETE FROM TAIWAN

Kuei-Yu Chen* and Zuei-Ching Chen**

*Associate Professor, Department of Biology,
Chinese Culture University, Taipei, Taiwan, R.O.C.
**Professor, Department of Botany, National Taiwan
University, Taipei, Taiwan, R.O.C.

Abstract

A new thermophilic fungus, *Thielavia pingtungia* sp. nov., isolated from sugarcane field soil in Taiwan is described and illustrated. It is characterized by brown, verrucose, hairy appendages on ascomata and cylindrical asci with uniseriate, dark, ovoid to globose ascospores with single apical germ pore. The optimum temperature for its growth is between 35°C and 50°C.

Key words: *Thielavia,* Sordariaceae, Plectomycetes, Ascomycotina, soil fungus, thermophilic, Fungal Flora of Taiwan.

During a survey of thermophilic fungi of Taiwan, an interesting species of *Thielavia* with mouse-gray colonies and dark ascomata with brown, hairy appendages was isolated. It has a high optimum growth temperature range of 35°C to 50°C ; thus, it is considered to be sufficiently different from other known thermophilic or thermotolerant species of this genus (Mouchacca, 1973; Pidoplichko, et al., 1973; Lodha, 1974; von Arx, 1975a, b; Davidson, 1976; Moustafa, 1976; Klopoteck, 1976; Udagawa & Sugiyama, 1981, 1982; Moustafa & Abdul-Wahid, 1990) to warrant its description as a new taxon. All dried culture specimens and living cultures are deposited at

Mycological Laboratory, Department of Botany, National Taiwan University (TAI-Mycology). Capitalized color names are those in Ridgway (1912).

***Thielavia pingtungia* K. Y. Chen & Z. C. Chen, sp. nov.**

Fig. 1-2 .

Coloniae in agaro YpSs ad 84 mm post 3 dies 40°C . Mycelia, griseola. Hyphae 2.1-3.5 µm diam Color Murinus Canus ad Saturatus, Murinus Canus, pallidus Fumus Canus in margo; reversum nigellus Canus.

Ascocarpae nonostiolatae, superficiales, globosae vel subglobosae 70-160 µm, brunneae. Asci cylindrici, 39-52 x 7-9 µm, stipitati, octospori, hyalini vel flavidi, leptodermi. Ascosporae fere uniseriatae, fere globosae vel subglobosae, brunneae, laeves, crassitunicatae, 6.3-8.5 x 8.5-9.7 µm.

Holotypus: Colonia exsiccata ex K-Y Chen 8608-5 (TAI-Mycology), ager solum in " Changchin Hsiang", Pingtung, Taiwan, 10.VIII.1986.

Etymology: Pingtungia, referring to Pingtung, the locality where this new species was isolated.

Colonies on YpSs, growing very fast, attaining 84 mm at 40°C in 3 days, aerial mycelium dense, composed of hyaline to pale gray, septate, branched hyphae, 2.1-3.5 µm in width, Mouse Gray to Deep Mouse Gray and Pale Smoke Gray in the margin, reverse Blackish Mouse Gray and Naple Yellow in the margin.

Ascomata borne on the hyphae, surperficial, non-ostiolate, globose to subglobose, 70-160 µm in diam., brown to deep brown or black brown, composed of a pseudoparenchymatous wall, with flexuous, undulate, brown, branched, thick-walled, hairy appendages, 2.5-4.0 µm in width, up to 350 µm long. Asci cylindric, 39-52 x 7-9 µm, stipitate, fasciculate, 8-spored, hyaline to pale yellow, thin-walled, evanescent at maturity. Ascospores usually uniseriate, few with an irregular arrangement, globose to subglobose or ovoid, few elliptical and at one end with a germ pore, at first hyaline, pale green, pale olive brown, becoming dark brown with smooth and darkened thick-walls, some

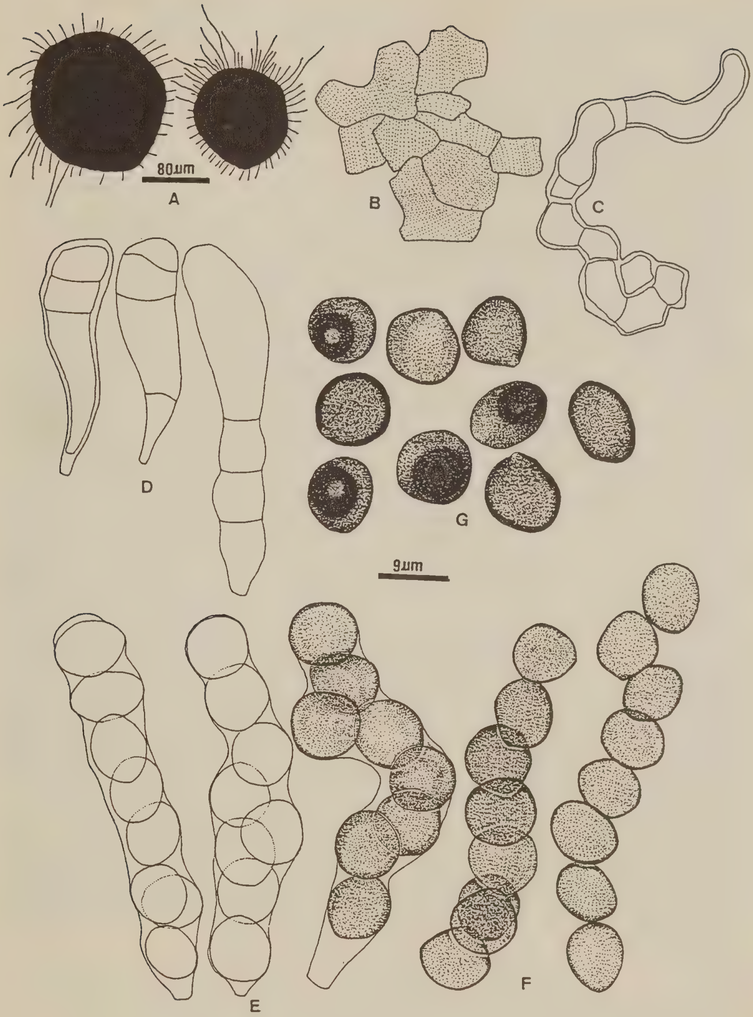


Fig. 1. ***Thielavia pingtungia*** sp. nov. (Chen 8608-5).
A. Ascoma, B. A portion of ascomal peridium. C. Hair. D. Young asci with undifferentiated ascospores, E. Asci with 8 ascospores. F. Ascospores. G. Ascospores with one germ pore.

containing a large guttule, 6.3-8.5 x 8.5-9.7 (10.0) µm. Conidia were not observed.

Habitat: **TAIWAN**: Pingtung: Changchin Hsiang, Plain, Field soils of sugarcane, 10 VIII, 1986. K-Y Chen 8608-5 (Holotype; TAI-Mycology).

Temperature tests: It is a thermophilic fungus. As shown in Table 1, the optimum temperature is between 35°C and 50°C. Ascomata are in general produced at 35°C and 40°C.

Thielavia pingtungia is a thermophilic fungus and differs from other thermophilic or thermotolerant species of *Thielavia* (s. st.) by having dark, septate, thick-walled, verrucose, branched, hairy appendages uniformly distributed on the surface of ascomata. Most thermophilic and thermotolerant species of *Thielavia*, i.e., *T. aegyptica* Moustafa & Abdul-Wahid, *T. arenaria* Mouchacca, *T. australiensis* Tansey & Jack, *T. emodensis* Udagawa & Sugiyama, *T. expansa* Udagawa & Sugiyama, *T. heterothallica* Klopotek, *T. subthermophila* Mouchacca, *T. terrestris* (Apinis) Malloch & Cain,, etc. have smooth ascomata and globose, ellipsoidal or clavate asci with irregularly arranged ascospores. *T. microspora* is a thermotolerant species with a weft of brown, septate, branched, appendage-like hyphae, 1.5-3 µm wide on the surface of ascomata. *Thielavia pingtungia* is thus close morphologically to *T. microspora,* but it differs in shape and size of asci and ascospores. It is also quite distinct from other non-thermophilic species of *Thielavia* having ascomata with hairy appendages or setae, i.e., *T. appendiculata* Srivastava et al., *T. fragilis* (Natarajan) v. Arx, *T. hyalocarpa* v. Arx, *T. hyrcaniae* Nicot, *T. minuta* (Cain) Malloch & Cain, *T. peruviana* (Gochenaur) Malloch & Cain, etc. *T. pingtungia* is characterized by having cylindcric asci, 39-52 x 7-9 µm, with uniseriate, ovoid to nearly globose ascospores, 8.5-10 x 6.3-8.5 µm. It differs from species of *Thielavia* with cylindric asci, i.e., *T. tetraspora* (Lodha & Mirza) v. Arx with 4-spored asci, *T. tortuosa* Udagawa & Sugiyama with twisted asci, *T. octospora* (Natarajan) v. Arx with nearly sphaerical ascospores, 10-12 µm in diam. and *T. hyalocarpa* with bigger asci, 70-100 x 11-18 µm.

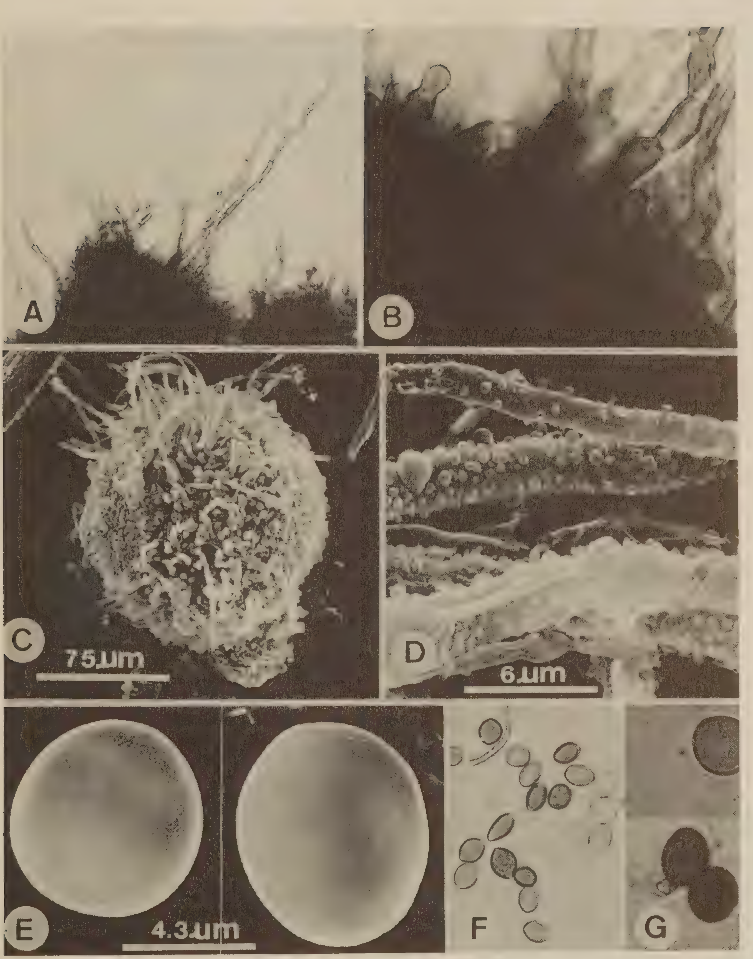

A
B
C
75µm
D
6µm
E
4.3µm
F
G

Fig. 2. ***Thielavia pingtungia*** sp. nov. (Chen 8608-5).
A & B. Hairs on the surface of ascoma. (A. x 125; B. x 500), C. An ascoma, D. Rough wall of hairs, E-G. Ascospores, (F. x 500; G. x 1250), (A-B & F-G. Under LM; C-E. Under SEM).

Table l. Radial growth and ascoma formation of *Thielavia pingtungia* (Chen 8608-5) on YpSs medium at various temperatures.

Temperature	Mycelial growth			Ascomata	
℃	3d	6d	9d	6d	9d
16	0	0	0	-	-
20	0	0	0	-	-
25	0	0	0	-	-
30	13	31	47	-	-
35	83	full*	full	+	+++
40	84	full	full	+	+++
50	83	full	full	-	-

*: Diameter of petri dish: 85mm
Growth: Colony diameter (mm) after 3, 6, 9 days (d).
Ascomata: (+++) abundant; (++) moderate; (+) slight and (-) not produced.

Acknowledgements

The authors wish to express their gratitude to Professor C.J.K. Wang, Department of Environmental and Forest Biology, State University of New York, College of Environmental Science and Forestry, Syracuse, and Professor C. V. Subramanian, Department of Botany, National Taiwan University, for reviewing the manuscript and making helpful suggestions. This work was partly supported by grants NSC 77-0211-B-002-01 and NSC 77-0606-B-002-167 to Z.C.C. The technical assistances offered by the staffs of Electron Microscope Laboratory, Department of Botany, NTU, are gratefully acknowledged.

Literature cited

Arx, J. A. von. 1975a. On *Thielavia* and some similar genera of Ascomycetes. Stud. Mycol. C.B.S. 8: 1-29.

Arx, J. A. von. 1975b. On *Thielavia angulata* and some recently described *Thielavia* species. Kavaka 3: 33-36.

Davidson, D. E. 1976. *Thielavia pseudomaritima* sp. nov. from a salt lake in Wyoming. Trans. Br. mycol. Soc. 66: 175-178.

Klopotek, A.V. 1976. *Thielavia heterothallica* sp. nov., die perfekt from von *Chrysosporium*. Arch. Microbiol. 107: 223-224.

Lodha, B. C. 1974. Studies on coprophilous fungi III. *Thielavia.* Nova Hedwigia Beih. 47: 361-366.

Malloch, D. and R. F. Cain. 1973. The genus *Thielavia.* Mycologia 65: 1055-1077.

Mouchacca, J.1973. Les *Thielavia* des sols arides: Especès nouvelles et analyse générique. Bull. Soc. Mycol. France 89: 295-311.

Moustafa, A. F. 1976. *Thielavia kuwaitensis* sp. nov. Trans. Br. mycol. Soc. 66: 336-337.

Moustafa, A. F. and O. A. Abdul-Wahid. 1990. *Thielavia aegyptica*, a new thermotolerant ascomycete from Egyptian soils. Persoonia 14: 173-175.

Pidioplichko, N. M., T. S. Kirilenko and V. A. Zakharchenko. 1973. New species of the genus *Thielavia* Zopf of the Ukrainian flora. Mikrobiol. Zh. Kiev 35: 723-729 (in Russian).

Ridgway, R. D., 1912. Color standards and color nomenclature. Publ. by the auther. Washington, D. C. 43 pp. 53 pl.

Udagawa, S. I. and Y. Sugiyama. 1981. Additions to the interesting species of Ascomycetes from imported spices. Trans. mycol. Soc. Japan 22: 197-212.

Udagawa, S. I. and Y. Sugiyama. 1982. New records and new species of ascomycetous microfungi from Nepal, a preliminary report on the expedition of 1980. On the Cryptogamic Study in Nepal (Miscellaneous publication of the National Science Museum, Tokyo), 11-46.

MYCOTAXON

Volume LX, pp. 249-256 October-December 1996

HYMENOSCYPHUS SEMINIS-ALNI, A NEW SPECIES OF THE H. FRUCTIGENUS-COMPLEX *

Hans Otto Baral

Blaihofstr. 42, D-72074 Tübingen, FRG

ABSTRACT

Hymenoscyphus seminis-alni is closely related to the *H. fructigenus*-complex (Leotiaceae). It differs from the hitherto known members of this group by long cilia on the ends of the ascospores, by the presence of croziers on the ascogenous hyphae, and by spores partly septate already within the living asci. The new species is so far only known from two localities in North and Eastern Germany, occurring on dispersed previous year's seeds of *Alnus* in alder carrs.

ZUSAMMENFASSUNG

Hymenoscyphus seminis-alni steht dem *H. fructigenus*-Komplex (Leotiaceae) sehr nahe, unterscheidet sich von den bisher bekannten Sippen aber durch lange Cilien an den Enden der Ascosporen, durch Haken an den ascogenen Hyphen, sowie durch Sporen, die bereits im lebenden Ascus teilweise septiert sind. Die neue Art ist bislang nur von je einem Fundort aus Nord- bzw. Ostdeutschland bekannt. Sie besiedelt ausgefallene vorjährige Samen von *Alnus* in Erlenbrüchen.

KEY WORDS: Ascomycetes, Leotiales, Leotiaceae, *Hymenoscyphus seminis-alni*, *Alnus* seeds

In his contribution to the mycoflora of an alder carr near Bremen, Grauwinkel (1987: 62) presented a detailed description of a remarkable species of *Hymenoscyphus* Gray which he collected on seeds of *Alnus glutinosa*, and which he tentatively named *H. fructigenus* (Bull. : Fr.) Gray. Later, a further locality of this species was detected by M. Eckel near Taura (Sachsen) on the same substrate. Through the kindness of both persons, I was able to obtain fresh collections from both sites, allowing study of the micromorphology in vital state. These specimens turned out to belong to an apparently undescribed species close to *H. fructigenus*.

---

* Contributions to the taxonomy of discomycetes V.

ABBREVIATIONS: H_2O = tap water, IKI = Lugol's iodine, KOH = potassium hydroxide 5%, CRB = aqueous cresyl blue, * = living state (in H_2O), † = dead state, LB = lipid body, VB = refractive vacuolar body, M = Botanische Staatssammlung München. Numbers in {} indicate in how many collections the reported feature was tested and seen, or from which locality the feature derives.

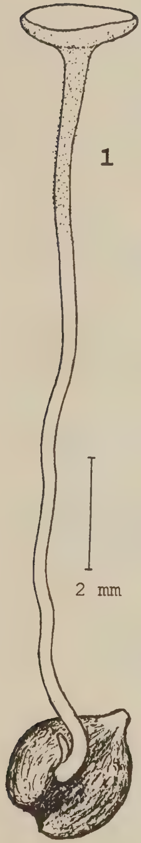
Hymenoscyphus seminis-alni Baral, B. Grauwinkel & M. Eckel spec. nov.

Ethymol.: semen (lat.) = seed, Alnus = alder, referring to the substrate.

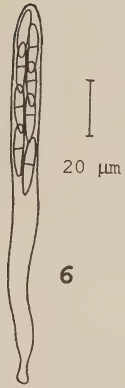
Apotheciis singulariter ex seminibus, disco 1-2.5 mm diam., ± plano, albis vel pallide ochraceis, glabris, stipitibus gracilibus, 6-20 x 0.15-0.45 mm. Ascis in statu vivo 120-140 x 8.7-10.5 µm, in statu emortuo 100-130 x 7-8 µm, apice conico, IKI coerulescente, e uncis natis. Ascosporis in statu vivo 16-24 x 3.5-5 µm, in statu emortuo 15-23 x 3.2-4.5 µm, 0-1 septatis in asco vivo, rectis, raro leniter curvatis, apice rotundato, basi attenuato, cum paucis guttulis magnis, polis cum 1-3 ciliis circiter 2.5-4.5 µm longis. Paraphysibus rectis, cylindraceis, obtusis, in statu vivo multiguttulatis. Excipulo ectale textura prismatica (-porrecta), strato externo hyphis guttulatis. Habitat ad seminibus emortuis Alni in Alnetis, in sero autumno.

Holotypus: Germany, Bremen, Huchting, NSG Sodenmatt, 9.XI.1995, B. Grauwinkel, HB 5370, depositus in M, 7 apotheciis.

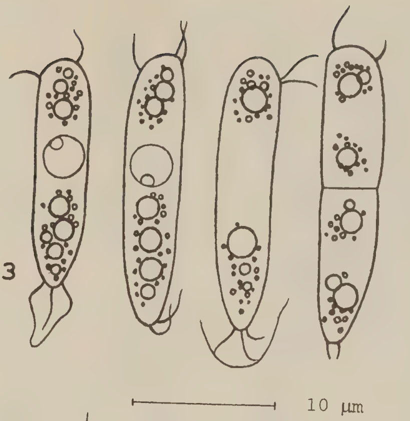
Apothecia: disc 1-2.5 mm in diam. when fresh {2}, slightly concave to slightly convex, white or very light cream, ± brownish when dry, margin and exterior smooth, concolorous, abruptly narrowed into a very long, cylindrical, often ± undulating, concolorous, sometimes somewhat transparent (glassy) stipe 6-20 mm long, 0.15-0.35 mm wide {2}, upwards widened to 0.4-0.45 mm and sometimes finely pubescent, base laterally inserted on scale of seed, one apothecium per seed (very rarely two), no external sclerotinization, growth negative geotropic. **Asci** *120-135 x 9.5-10.5 µm {Taura}, *133-140 x 8.7-9.5 µm {Bremen}, $\dagger_{H2O}$ (100) 115-125 x 7.2-7.7 µm {Taura}, $\dagger_{KOH}$ (100) 110-130 x 7-7.5 (8) µm {Bremen}, pars sporifera *50-67 µm long {2}, $\dagger_{KOH}$ 68-85 µm, 8-spored, spores biseriate (also in dead asci but here lower spores often ± uniseriate), forcible spore discharge not rarely seen in water mounts; apex distinctly (broadly) conical, apical thickening immature 1.7-2.4 µm, mature 1-1.3 µm thick ($\dagger_{IKI}$), apical ring euamyloid, moderately to strongly blue (BB) in IKI, occupying only the lower 1/3 - 3/4 of the thickening *(Hymenoscyphus*-type); base with a ± short, somewhat undulating stalk, arising from croziers {4}. **Ascospores** ejected *16.3-20.3 x (4) 4.3-4.7 µm {Taura}, *(14.3) 16-21 x 3.8-5 µm {Bremen}, within living asci *16.5-20 (21.5) x 3.4-4 µm {Taura}, within dead asci *(15) 16.5-20.5 (24) x (3.5) 3.8-4.7 µm {Taura}, $\dagger_{H2O}$ 16-20.5 x 3.5-4 µm {Taura}, $\dagger_{KOH}$ 15-23 x (3.2) 3.5-3.8 (4-4.5) µm {Bremen}, 0-1 septate within mature living asci (either all {Bremen} or c. 50% of the asci {Taura} with 2-7 two-celled spores per ascus, especially the lower spores with septa), straight, rarely very slightly curved, slightly to distinctly scutuloid, apex broadly rounded, with a short lateral edge, moderately tapered towards ± rounded base; both ends with 1-3 distinct, mostly curved cilia (1) 2.5-4.5 (5) µm long {4}, cilia persistent in KOH (but easily overlooked in that mountant); living spores with ≈1-2 large LBs 1.3-2.3 µm diam. (-2.8 µm through coalescence), surrounded by some smaller and several minute LBs (lipid content comparatively high), LBs persistent in KOH, 1 nucleus ≈3 µm diam. in each cell; spore wall surface ± unstained in CRB. **Paraphyses** straight, cylindrical, *2.5-3.2 µm wide near base



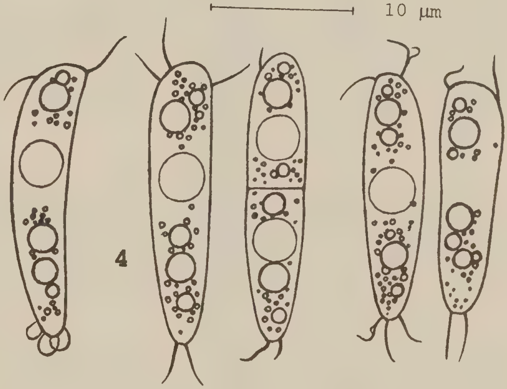
1



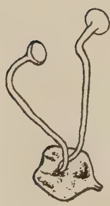
6



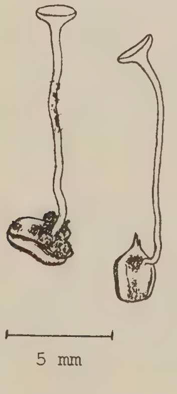
3

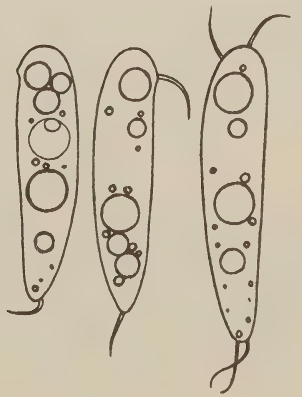


4

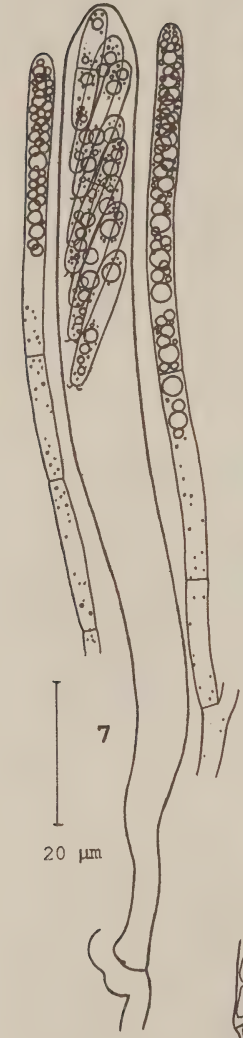


2

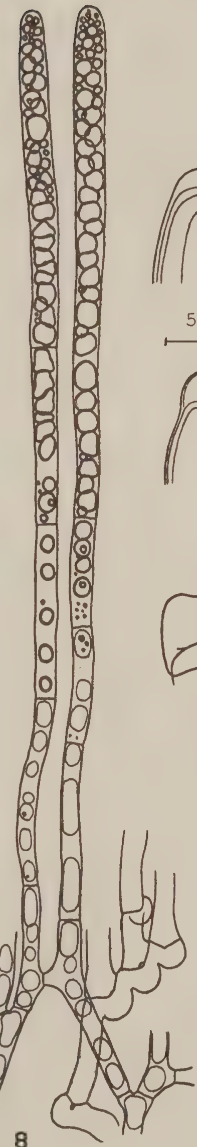




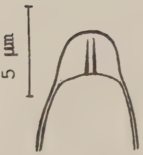
5



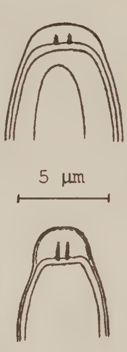
7



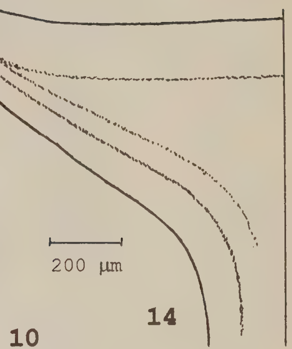
8



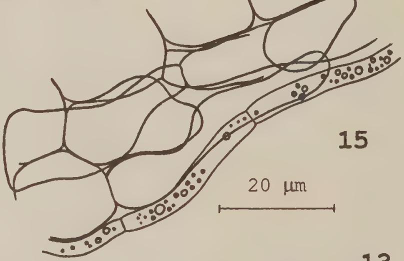
9



10

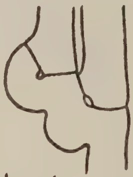


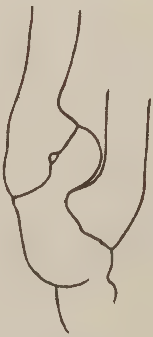
14



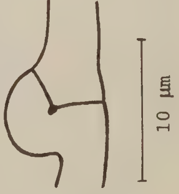
15

13





11



12

($\dagger_{\mathrm{KOH}}$ 1.5-2.5 µm), not or only very slightly enlarged towards apex, obtuse, protruding ≈0-5 µm beyond asci ($\dagger_{\mathrm{KOH}}$, mature living asci protrude 0-12 µm beyond paraphyses {2}), terminal cell *40-74 x 3-4.2 (4.7) µm {2} ($\dagger_{\mathrm{KOH}}$ 42-75 x 2.7-3.5 µm), dichotomously branching towards base and with many anastomoses; living paraphyses densely filled with strongly refractive, globose, finally angular vacuolar bodies (multiguttulate, VBs) in the region from apex (25) 40-80 (90) µm downwards {2}, VBs deep turqueois in CRB, deep redbrown in IKI, dissolving in KOH, disappearing in herbarium material (in dead paraphyses mounted in H_2O the mentioned region may show a pale greyish-violet or yellowish-reddish plasmatic colour through oxidation of a substance in the VBs). **Ectal excipulum** a horizontally oriented (≈10-20°), ± undulating textura prismatica-porrecta, textura porrecta in stipe, on flanks ≈40 µm thick, individual cells *≈15-45 x 11-18 µm ($\dagger_{\mathrm{KOH}}$ ≈20-50 x 6-13 µm), at base of receptacle ≈100 µm thick, cells *30-82 x (7) 10-17 (23) µm {2}; covered by a single layer of hyphae 3-6 µm diam. containing scattered refractive guttules (VBs). **Medullary excipulum**: inner part a ± loose textura intricata, ≈120 µm thick near base of receptacle, of ± undulating hyphae *2-6 µm wide; outer part a dense textura porrecta, ≈60-70 µm thick near base of receptacle, individual cells *42-82 x 3-4 (5) µm, with anastomoses. **Ecology:** in late autumn in alder carrs with *Iris pseudacorus*, *Oenanthe aquatica*, *Alisma plantago*, on previous year's seeds of *Alnus glutinosa* {4} lying dispersed on or in wet litter below herbaceous vegetation. A detailed description of the Bremen locality is given by Grauwinkel (1987: 4). The apothecia are drought-intolerant except for the spores some of which survived for at least 2 weeks in the herbarium.

Specimens examined (HB 4974b and HB 5370 in fresh state):

Germany: Bremen, Huchting, NSG Sodenmatt, MTB 2918, ≈2 m, 22.XI.1981, leg. B. Grauwinkel, HB 2946; dto., 9.XI.1995, leg. B. Grauwinkel, HB 5370 (holotype, deposited in M; isotype: herb. Grauwinkel). --- Sachsen, Taura, Kühnhaider Wald, MTB 5043/3.3, ≈320 m, 7.XI.1993, leg. M. Eckel, HB 4974a & herb. Eckel 93/31-07; dto., 14.XI.1993, leg. M. Eckel, HB 4974b & herb. Eckel.

This new species so far only is known from two very remote sites of the northern and eastern region of Germany. *H. seminis-alni* is distinguished from the common *H. fructigenus sensu lato* (1) by the presence of long cilia on the spore ends, (2) by the asci arising from croziers, and (3) by many or all of the living, mature, 8-spored asci containing 2-7 two-celled spores. The long and tiny stalk might serve as a macroscopic character but is similarly present in *H. fructigenus* var. *carpini* (Batsch) Hengstm. No other species of the genus is known to me to occur on seeds of *Alnus*, an ecological niche to which the present species possibly is adapted. The occurrence in late autumn also seems to distinguish it from *H. fructigenus*.

Figs. 1-15. *Hymenoscyphus seminis-alni*. **Figs. 1-2.** Apothecia on seeds of *Alnus* (fig. 1. x8, fig. 2. x3); **figs. 3-5.** Ascospores (x2000); **fig. 6.** Ascus with seven 1-septate spores (x400); **figs. 7-8.** Ascus containing six aseptate and two 1-septate spores, paraphyses (x1000); **fig. 9-10.** Apices of asci in IKI (x2500); **figs. 11-13.** Bases of asci with croziers (x2000); **fig. 14.** Section of receptacle, x50; **fig. 15.** Section of ectal excipulum (lower flanks, x800). All from living cells in H_2O except figs. 9-10 (IKI) and 13 (KOH). From Taura: HB 4974b: figs. 1, 4, 6, 12, 15; HB 4974a: 5, 9, 13; from Bremen: HB 2946: fig. 10; HB 5370 (holotype): figs. 2, 3, 7, 8, 11, 14.

Ciboria seminicola (Kienholz & Cash) Hechler (= *Ciboria alni* (Rostr.) Buchw.) also occurs only on alder seeds but fruits in early spring (February). It is distinguished by hazel-brown, cupulate apothecia of 2-6 mm diam. with stipes 2-12 mm long. 1-5 apothecia arise from each seed. The apical apparatus of asci is typical for the Sclerotiniaceae to which this species belongs, but the asci arise from simple septa, a rare feature in this family. The spores are decidedly fusoid, *12-18 (21) x 4.5-5.5 µm, finely warted, without cilia, and contain only some small LBs. The living paraphyses are devoid of distinct large guttules.

According to Grauwinkel (l.c.), the alder seeds infected by *Hymenoscyphus seminis-alni* have the same size (2.5 x 2 x 0.5 mm) and colour (dark brown) as uninfected seeds, but in section the embryo is absent, and the endosperm is comparatively thin and has an innermost layer showing black stromatic colour. Those alder seeds infected by *Ciboria seminicola* are distinctly larger (4 x 3.5 x 0.7 mm) and show a black stroma of the testa; the embryo is here also absent while the endosperm is very abundant (see Grauwinkel, 1987: fig. 24).

Ciboria uliginosa (Fr.) Rehm as reported by Velenovský (1934: 220) on cones of *Alnus* in summer and autumn, is habitually similar to *H. seminis-alni* but is said to have brownish apothecia and ellipsoid eguttulate ascospores 5-10 µm long suggesting a Sclerotiniaceae. Authentic *Ciboria uliginosa*, however, is considered a synonym of *Cudoniella clavus* (Alb. & Schw.: Fr.) Dennis (see Rehm, 1896: 1262).

The *Hymenoscyphus fructigenus*-complex is a very difficult group comprising several fructicolous varieties or species. Each of these taxa is believed to be confined to fruits of a different tree. All occur in early autumn ([Aug.] Sept.-Oct. [Nov.]) and not necessarily in wet places like swamps etc. The type of *H. fructigenus* occurred on acorns of *Quercus* (Lizoň, 1992: 22). *H. rokebyensis* Dennis was separated on specific rank for collections on cupules of *Fagus*. *H. fructigenus* var. *aesculicarpa* Sydow, *H. f.* var. *coryli* (Feull. in Rom.) Hengstm. and *H. f.* var. *carpini* were recognized for collections on cupules of *Aesculus*, seeds of *Corylus*, and seeds of *Carpinus* respectively. I have examined a larger number of collections on these substrates, also some on cones of *Pinus*, seeds of *Acer*, and seed scales of *Juglans*. Collections on seeds of *Prunus spinosa* were reported by Dennis (1956: 80), on nut husks of *Hicoria* by Seaver (1951: 121). *"Helotium" nyssicola* Seaver, on seeds of *Nyssa sylvatica*, was restudied by Dennis (1964: 57); the ascospores are said to be without cilia, and Dennis placed this taxon in synonymy of *H. fructigenus*.

A further apparently undescribed taxon of this complex was found by me to occur not rarely on fallen previous year's cones of *Alnus glutinosa* (the cones did not contain any seeds). This taxon differs by comparatively long [*(17) 20-28 (32) x (3) 3.5-4.5 (5) µm], distinctly scutuloid ascospores without or with 1-3 cilia (0.2-0.7 µm long) at each spore end. A further unidentified collection on this substrate differs from this and *H. fructigenus* by short, thick, only slightly scutuloid spores (*14.5-19 x 4.5-5.5 µm) without cilia.

The separation of this difficult complex of fruit-inhabiting species into different taxa seems practicable but a thorough morphological investigation has not been undertaken. The complex possibly is not a strictly monophyletic group because caulicolous, foliicolous, and even lignicolous taxa seem very closely related. All collections of the *H. fructigenus*-complex studied by me, and occurring on substrates other than *Alnus* seeds, differ consistently from *H. seminis-alni* in at least two characters: (1) the asci always arise from simple septa, (2) the spore ends are without cilia or have very short cilia (a collection on seeds of *Corylus* had 1-3 exceptionally long cilia [0.6-1.5 µm] at each spore end). Possibly, a third character: septate spores within living asci, was also consistently absent in these collections (nevertheless, septate spores may occur in these taxa outside the asci, or within dead asci). Finally, I have not found any literature reports on such small seeds like those of *Alnus* as the host for species of this complex.

Hymenoscyphus scutula (Pers. : Fr.) Phill. has cilia of a length similar as *H. seminis-alni*, viz. (0.5) 2.5-3 (5) µm, but there is only one cilium per spore end (rarely two). The asci are consistently without croziers (see also White, 1942: fig. 6), and the apothecia have a much shorter stipe. The species occurs on herbaceous stems of various dicots, also on large petioles of deciduous trees. I tend to concur with White (l.c.) who found collections of *H. scutula* with non-ciliate spores to be otherwise indistinguishable. Since I have studied only a few specimens of *H. seminis-alni*, variation in both length and number of the cilia in this species might similarly occur. In any case, cilia longer than c. 1 µm are a very rare feature in the genus and have, according to my literature, so far only been reported for *H. scutula* (see also Lizoň, 1992: 10).

There exist, however, two seemingly undescribed species close to *H. calyculus* (Sow.: Fr.) Phill. *ss. auct.*, with 1-3 cilia at each spore end, 1-3 (4) µm long: one occurs in the Alps on twigs of *Alnus* (asci with croziers, spores *16-19.5 x 4.5-5.5 µm), the other was found in Luxembourg on twigs of *Carpinus* (asci without croziers, spores *33-38 x 6.5-7 µm). In both species the large apothecia have comparatively short stipes (c. 0.3-1.5 mm long), unlike *H. seminis-alni*.

The presence of long cilia in *H. seminis-alni* was considered by Grauwinkel (1987: 78) to facilitate spore dispersal in wet habitats. I cannot believe in this because the above-mentioned species with ciliate ascospores usually do not occur in wet places.

The presence or absence of croziers is very often neglected in taxonomic studies on the Leotiales. Thus, no information on this useful character can be found in the descriptions of species of *Hymenoscyphus* in the studies of, e.g., Velenovský (1934), Seaver (1951), Dennis (1956), Svrček (1985), and Lizoň (1992). White (1942, 1943, 1944), however, carefully took notice of the ascus base, depicted it accurately, and used it as an additional key character in separating species of *Hymenoscyphus sensu lato* (as "*Helotium*"), e.g. in a key on page 139 (White, 1943). Dumont (1981 a, b), on the other hand, mentioned indeed the feature in his descriptions of species referred to *Helotium* Pers. ex Gray and *Hymenoscyphus*, but he often expressed his uncertainty about it, and he was unable to report a clear case of simple septate ascogenous hyphae in any of the treated species although this case is so frequent in species of *Hymenoscyphus* with scutuloid spores. Likewise, Huhtinen (1990) based the delimitation within several closely related taxa of the genera *Hyaloscypha* Boud. and *Hamatocanthoscypha* Svrček mainly on this character. In taxa he believed to be critical, Huhtinen preferred to recognize only two different varieties, one with croziers, the other with simple septa.

Dumont (1981 b: 80) found, "for some unexplained reason", a great variability in spore septation when studying herbarium material of *Hymenoscyphus caudatus* (P. Karst.) Dennis and allied taxa: in some collections all of the ascospores were 1-septate, while in others most of them were aseptate and only few had a septum. One of the reasons for such a variability is the fact that the number of septate spores strongly increases with the age of the population. Contrary to this, the number of septate spores within living, mature asci is a much more constant value, being independent of the age of the apothecium, in my experience, and having therefore a much higher taxonomical significance. This character cannot, however, be re-examined from herbarium material since fresh apothecia usually contain both living and dead asci, and all these asci are finally dead after desiccation (see Baral, 1992: 376).

I prefer to recognize *H. seminis-alni* as different from *H. fructigenus* on specific level because the deviating character of the ascus base is correlated with several other features (cilia on the spores, spore septation, ecological and phenological differences).

ACKNOLEDGEMENTS

I wish to thank Bernt Grauwinkel (Bremen) and Matthias Eckel (Taura) for their help in providing fresh specimens, and Prof. Donald H. Pfister (Cambridge) for reviewing a former version of the manuscript.

REFERENCES CITED

BARAL, H. O. (1992). Vital versus herbarium taxonomy: morphological differences between living and dead cells of ascomycetes, and their taxonomic implications. - Mycotaxon 44 (2): 333-390

DENNIS, R. W. G. (1956). A revision of the British Helotiaceae. - Mycol. Papers 62: 1-216

--- (1964). Remarks on the genus *Hymenoscyphus* S.F. Gray, with observation on sundry species referred by Saccardo and others to the genus *Helotium*, *Pezizella* or *Phialea*. - Persoonia 3: 29-80

DUMONT, K. P. (1981 a). Leotiaceae II. A preliminary survey of the neotropical species referred to *Helotium* and *Hymenoscyphus*. - Mycotaxon 12: 313-371

--- (1981 b). Leotiaceae III. Notes on slected temperate secies referred to *Helotium* and *Hymenoscyphus*. - Mycotaxon 13: 59-84

GRAUWINKEL, B. (1987). Beitrag zur Pilzflora des Erlenbruchwaldes NSG Sodenmatt bei Bremen. - Veröffentlichungen aus dem Übersee-Museum Bremen A, 8: 1-165, pl. 1-2

HUHTINEN, S. (1990). A monograph of *Hyaloscypha* and allied genera. - Karstenia 29 (2): 45-252

LIZOŇ, P. (1992). The genus *Hymenoscyphus* (Helotiales) in Slovakia, Czechoslovakia. - Mycotaxon 45: 1-59

REHM, H. (1896). Rabenh. Krypt.-Flora, 2. Aufl., 1,3: Ascomyceten: Hysteriaceen und Discomyceten. Leipzig

SEAVER, F. J. (1951). The North American cup fungi (inoperculates). New York, 428 pp.

SVRČEK, M. (1985). A taxonomic revision of Inoperculate Discomycetes described by J. Velenovský in the genus *Helotium*, preserved in National Museum, Prague ("1984"). - Sb. Nár. Mus. Praze/ Acta Mus. Nat. Prag. (B) 40 (3-4): 129-215

VELENOVSKÝ, J. (1934). Monographia Discomycetum Bohemiae, Pragae.

WHITE, W. L. (1942). Studies in the genus *Helotium*. I. A review of the species described by Peck. - Mycologia 34: 154-179

--- (1943). Studies in the genus *Helotium*, III. History and diagnosis of certain European and North American foliicolous species. - Farlowia 1 (1): 135-170

--- (1944). Studies in the genus *Helotium*, IV. Some miscellaneous species. - Farlowia 1 (4): 599-617

MYCOTAXON

Volume LX, pp. 257-262 October-December 1996

AMOENODOCHIUM HUMICOLA ANAM. GEN. ET SP. NOV., A NEW SPORODOCHIAL HYPHOMYCETE FROM INDIAN SOIL

FERNANDO PELÁEZ

Centro de Investigación Básica
Merck, Sharp and Dohme de España
Josefa Valcárcel, 38, 28027 Madrid, Spain

RAFAEL F. CASTAÑEDA RUIZ

Instituto de Investigaciones Fundamentales en Agricultura Tropical "Alejandro de Humboldt"
Santiago de las Vegas, Calle 1, Esq. 1, Ciudad de la Habana, Cuba

Abstract

Amoenodochium humicola, isolated from soil in India, is described and illustrated as a new genus and species of sporodochial hyphomycetes. The taxon is characterized by the production of pulvinate green-brown sporodochia with sympodially proliferating polyblastic and strongly denticulate conidiogenous cells, and turbinate or cuneiform one-celled conidia, which are fimbriate at the base and crown-like at the apex.

Resumen

Se describe e ilustra *Amoenodochium humicola* como un nuevo género y especie de hifomicetos esporodoquiales, aislado de suelo. El taxon se caracteriza por la producción en cultivo de esporodoquios pulvinados verde-parduzcos, con células conidiogénicas poliblásticas, proliferando simpodialmente, fuertemente denticuladas, y por conidios unicelulares turbinados o cuneiformes, fimbriados en la base y ornamentados con una corona en el ápice.

Introduction

During a survey of tropical soil fungi, we isolated from a soil sample collected in Goa, India, a fungus that developed green-brown sporodochia scattered on the agar surface after a short period of incubation. When the isolate was examined microscopically, the conidiogenous cells and conidia were seen to differ significantly from all other known sporodochial hyphomycetes. A new genus and species is thus proposed to accommodate this interesting fungus.

Materials and Methods

The fungus was isolated from a soil sample collected in a semi-deciduous forest near Bondla, Goa, India, using a modification of the soil washing technique (Parkinson & Williams, 1961), on DRBC medium (Oxoid). The growing colonies were transferred to potato dextrose agar (PDA) plates for identification. Mature sporodochia were observed after 7 days growth at 22°C under fluorescent light on a 12 hour light/dark cycle. In the descriptions, capitalized color names are from Kornerup & Wanscher (1963). PDA, oatmeal agar (OMA) and cornmeal agar (CMA) were prepared media from Difco Laboratories. Yeast malt agar (YME) was prepared as medium M-67 described by Stevens (1981). Microphotographs were taken with a Leitz Diaplan microscope equipped with Nomarski interference optics.

Description of new taxa

Amoenodochium Peláez et Castañeda Ruiz, *anam. gen. nov.*

Conidiomata sporodochia, superficialia, dissita vel confluens, pulvinata, brunnea. Mycelium superficiale et partim in substrato immersum. Conidiophora conspicua, mononematosa, fasciculata, geniculata, subhyalina usque pallide brunnea. Cellulae conidiogenae polyblasticae, sympodiales, denticulatae, integratae, terminales. Conidia turbinata, cuneiformia, late pyriformia usque obovoidea, unicellularia, simplicia, sicca, brunnea, conspicua fimbriata ad basim. Teleomorphosis ignota.

Species typica: *Amoenodochium humicola* Peláez et Castañeda Ruiz, sp. nov.

Conidiomata sporodochial, superficial, scattered or confluent, pulvinate, brown. Mycelium immersed and superficial. Conidiophores differentiated, mononematous, fasciculate, geniculate, subhyaline to pale brown. Conidiogenous cells polyblastic, sympodial, denticulate, integrated, terminal. Conidia turbinate, cuneiform, broadly pyriform to obovoid, one-celled, simple, brown, conspicuously fimbriate at the base. Teleomorph unknown.

Type species: *Amoenodochium humicola* Peláez & Castañeda Ruiz, sp. nov.

ETYMOLOGY: From the latin *amoenus* = "delightful", in reference to the appearance of conidia and conidiogenous cells.

Amoenodochium humicola Peláez et Castañeda Ruiz, *anam. sp. nov.*

Mycelium ex hyphis septatis, laevibus, hyalinis. Conidiomata sporodochia, superficialia, dissita vel confluens, pulvinata, brunnea, 100-500 µm diam. Conidiophora conspicua, mononematosa, fasciculata, geniculata, levia, hyalina usque leviter brunnea, 50-75 x 4-6 µm. Cellulae conidiogenae polyblasticae, sympodiales, denticulatae, integratae, terminales, hyalinae usque leviter brunneae. Conidia turbinata, cuneiformia usque late pyriformia, unicellularia, simplicia, sicca, levia, subhyalina usque pallide brunnea, conspicua fimbriata ad basim, coronata ad apicem, 7-14 x 4-7 µm, 2-3 µm crassa ad basim. Teleomorphosis ignota.

TYPUS: Ex humus, Goa, India, 11 April 1994, F. Peláez. Teges culta sicca (holotypus) in herbarium MA-Fungi (MA-33881). Isotypus in IMI.

Mycelium composed of septate, smooth, hyaline hyphae. Conidiomata sporodochial, superficial, scattered or confluent, pulvinate, brown, 100-500 µm diam. Conidiophores differentiated, mononematous, fasciculate, geniculate, smooth, hyaline to pale brown, 50-75 x 4-6 µm. Conidiogenous cells polyblastic, sympodial, denticulate, integrated, terminal, hyaline to pale brown. Conidia turbinate, cuneiform to broadly pyriform, one-celled, simple, dry, smooth, subhyaline to pale brown, conspicuously fimbriate at the base, crowned at the apex, 7-14 x 4-7 µm, 2-3 µm wide at the base. Teleomorph not observed.

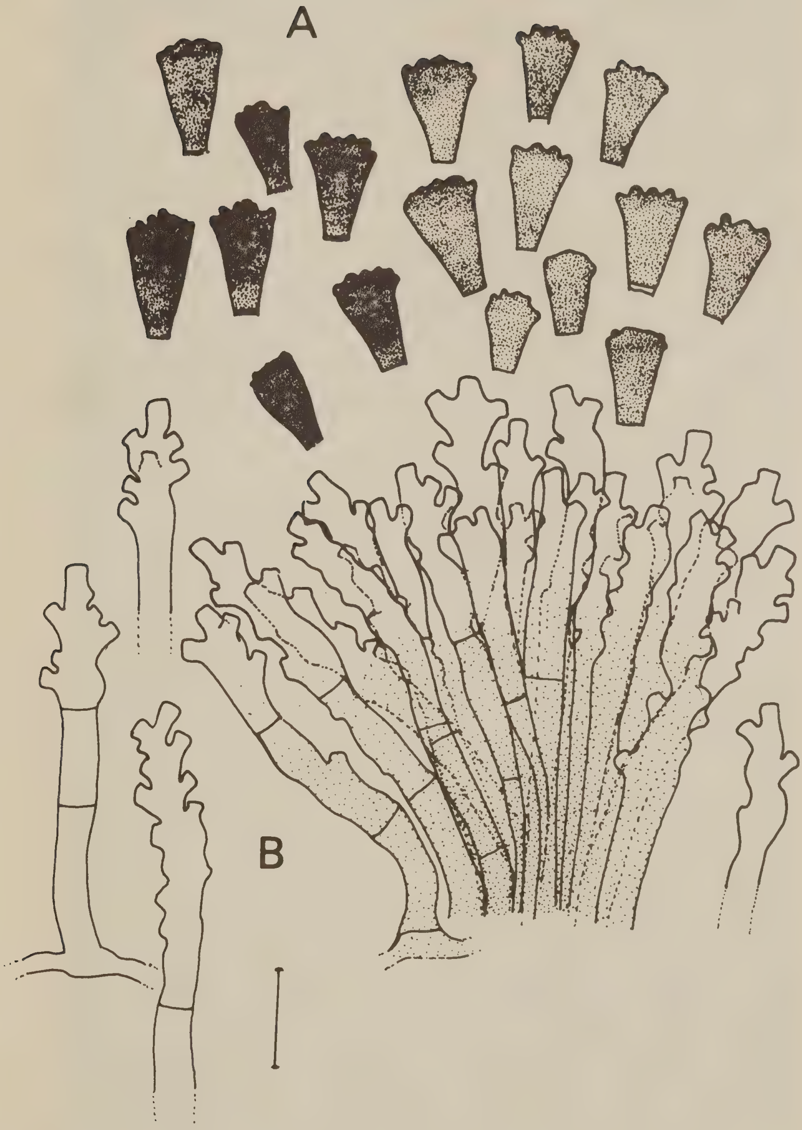


Fig. 1. *Amoenodochium humicola*. A. Conidia. B. Sporodochium, conidiophores and conidiogenous cells. Bar: 10 µm.

ETYMOLOGY: From the latin *humicola* = "living in soil", in reference to the habitat of the fungus.

HABITAT: from forest soil

SPECIMEN EXAMINED: Goa, India, 11 April 1994, F. Peláez. Dried culture mat (holotype) in herbarium MA-Fungi (MA-33881). Isotype in IMI.

CULTURAL CHARACTERISTICS: On PDA attaining a diameter of 61-64 mm in 2 weeks at 25°C and 50% RH, radially sulcate, margin uneven, appressed to submerged, aerial mycelium floccose, white. Sporodochia distributed in the inner two thirds of the colony, eventually forming concentric rings, densely grouped at the center. Colony Brownish Gray, dark Greenish Gray at the center, White at the margin. Reverse Pale Yellow at the center, Yellowish Gray at the middle zone, Yellowish White at the margin. Odors and exudates absent.

On CMA attaining a diameter of 48-52 mm, margin uneven, submerged, aerial mycelium absent except for some sparse white radial strands. Colony colorless, with few sporodochia scattered near the center. Odors and exudates absent.

On OMA attaining a diameter of 53-56 mm, margin uneven, appressed, aerial mycelium sparse, subfelty, floccose, forming white radial strands. Brownish gray sporodochia scattered over inner half of colony. Odors and exudates absent.

On YME attaining a diameter of 63-65 mm, radially sulcate, margin uneven, appressed, aerial mycelium felty, floccose, Orange Gray (Alabaster), Grayish Orange. Sporodochia absent, even after longer incubation. Reverse Light Yellow, Pale Yellow. Odors and exudates absent.

The fungus grows optimally at about 25°C. At 22°C and 28°C the radial growth rate decreases slightly with respect to the optimum (49-52 mm diam in PDA, in two weeks). At 15°C growth was much slower (18-20 mm diam in the same medium and period), and sporulation was absent. No growth was observed at 10°C nor at 37°C.

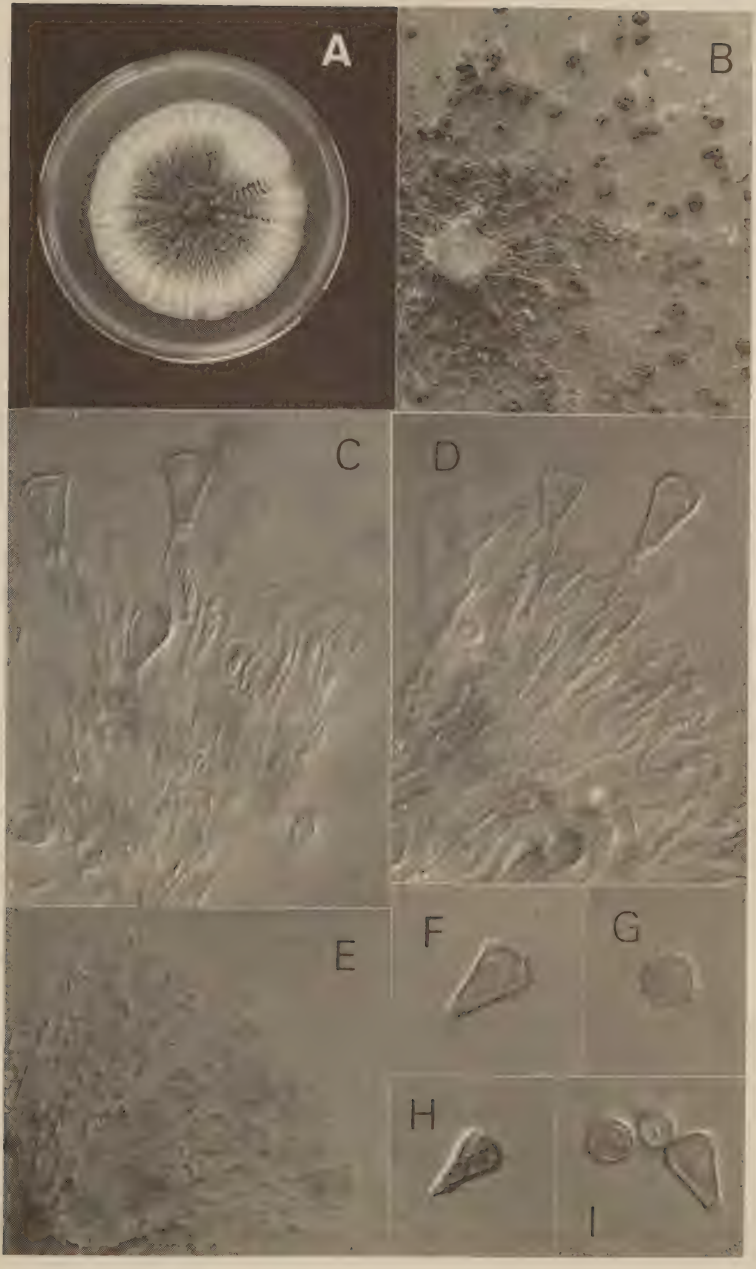
Discussion

Amoenodochium humicola shows some similarities to *Asperisporium caricae* (Speg.) Maublanc, *Polythrincium trifolii* Kunze ex Ficinus & Schubert, (Ellis, 1971), *Scolecobasidiella tropicalis* Castañeda & G. Arnold (Arnold & Castañeda, 1986) and *Ticogloea guttulata* Weber, Spaaij & Gams (Weber *et al.* 1994), four hyphomycetes associated with plants. All these species develop brown sporodochia or aggregations of conidiophores resembling sporodochia, with sympodial conidiogenous cells. However, the conidiogenous cells in genera *Asperisporium*, *Polythrincium* and *Ticogloea* are flat and less conspicuous, whereas in *Amoenodochium* and *Scolecobasidiella* these are conspicuously denticulate. The upper half of the branched conidiophores in *Scolecobasidiella* terminate into sterile, filiform appendages, while in *Amoenodochium* the conidiophores are entirely fertile.

The conidia of all five species are clearly distinct from each other. In *A. caricae*, the conidia are almost always one-septate, ellipsoidal, pyriform or clavate, hyaline to pale brown, verrucose and 14-26 x 7-10 µm. In *S. tropicalis*, the conidia are one-septate, brown, oblong, bluntly rounded at both ends, smooth, slightly constricted at the septa and 8-12 x 2.5-4 µm. The conidia in *P. trifolii* are one-septate, hyaline to pale brown, oblong, cuneiform or pyriform, smooth and 17-24 x 13-24 µm. In *T. guttulata*, conidia are non-septate, dark brown, ovoid, slightly truncate at the base and

---

Fig. 2. *Amoenodochium humicola*. A. Two-week old culture mat on PDA (x 0.65). Note dark sporodochia at the center. B. Sporodochia on OMA (x 4.2). C, D. Conidiophores and conidiogenous cells with conidia attached (x 1250). E. Conidiophores and conidiogenous cells showing the denticles (x 1250). F-I. Mature conidia (x1250). Note the fimbriate base (F, H) and the crown-like ornamentation of the apex (G, I, top view).


A
B
C
D
E
F
G
H
I

4-5 x 3-3.5 µm. The conidia of *A. humicola* are one-celled, cuneiform, 7-14 x 4-7 µm, and patently fimbriate at the base.

The habitats of these fungi also differ. *Asperisporium caricae* inhabits living leaves of *Carica papaya* L. in Central America, and *P. trifolii* is a widely distributed plant pathogen causing sooty blotch disease on *Trifolium*. *Scolecobasidiella tropicalis* was originally described from dead leaves of *Calophyllum calaba* L. in Cuba, but it has also been found on leaf debris of cranberry (*Vaccinium macrocarpon* Ait.) in Massachusetts, as a later synonym *Mycosisymbrium cirrhosum* Carris (Carris, 1994). *Ticogloea guttulata* has been reported from roots of *Ticodendron incognitum* Gómez-Laurito & Gómez P. and *Tilia platyphyllos* Scop., in Costa Rica and Germany respectively. At present, *Amoenodochium humicola* is only known from soil and it has not been isolated from leaf litter collected in the same area, although it cannot be discarded that it may also be present in plant material.

Literature

- Arnold, G.R.W. & Castañeda Ruiz, R.F. (1986). Neue Hyphomyzeten-Arten aus Kuba. Feddes Repertorium 97: 79-88.
- Carris, L.M. (1994). *Vaccinium* fungi: *Mycosisymbrium cirrhosum* gen. et sp. nov. Mycologia 86: 131-133.
- Ellis, M.B. (1971). Dematiaceous Hyphomycetes. Commonwealth Mycological Institute. Kew, England.
- Kornerup, A. & Wanscher, J.H. (1963). Methuen Handbook of Colour. Methuen, London.
- Parkinson, D. & Williams, S.T. (1961). A method for isolating fungi from soil microhabitats. Plant and Soil 13: 347-355.
- Stevens, R.B. (1981). Mycology Guidebook. University of Washington Press. Seattle and London.
- Weber, G., Spaaij, F. and Gams, W. (1994). *Ticogloea*, a new genus of hyphomycetes from roots of *Ticodendron incognitum* from Costa Rica. Mycol. Res. 98: 660-664.

MYCOTAXON

Volume LX, pp. 263-273 October-December 1996

MYCENA SORORIA SP. NOV., CLOSE TO *M. ROSEA* GRAMBERG (*BASIDIOMYCOTINA*)

J. PERREAU-BERTRAND, M.C. BOISSELIER-DUBAYLE
and J. LAMBOURDIERE

C.N.R.S. (U.M.S. 826, G.D.R. 1005)
Laboratoire de Cryptogamie, 12 rue Buffon. F - 75005 Paris.

Abstract - The electrophoretic comparison of six isozyme activities in *Mycena rosea* and two differently pigmented - pink and lilaceous - forms of *Mycena pura* (section *Calodontes*) demonstrates the specific characterization of *M. sororia* and its affinity to *M. rosea*..

Key words - Electrophoresis, isozymes, biological species, taxonomy, *Mycena*, *Basidiomycotina*.

Introduction

The electrophoretic analysis of isozymes provides some genetic informations when morphological or other biochemical characters appear to be insufficient for species delimitation. This technique is used since a long time for fungal systematics (Blaich, 1977; Micales & al., 1986; Molitoris & Prillinger, 1986) and many valuable results were already obtained in several groups. Taxonomic units have been defined by this procedure in diverse genera of Ascomycetes such as *Morchella* (Yoon & al., 1990) and *Tuber* (Pacioni & Pomponi, 1991; Pacioni &

al., 1993) or Basidiomycetes : *Polyporus* (Shannon & al., 1973), *Pleurotus* (Boisselier-Dubayle, 1983; Zervakis & al., 1994), *Armillaria* (Lin & al., 1989) or *Agaricus* (Royse & May, 1982). For the same purpose, a study was carried out, in the genus *Mycena* (*Tricholomatales*), on *M. pura* (Pers. : Fr.) Kumm.

By the main features of its basidiomata, *Mycena pura* belongs to the section *Calodontes* (Fr. ex Berk.) Quél. and more particularly to the subsection *Purae* (Konr. & Maubl.) Maas Geest. In its original sense, this taxon comprised four varieties differing from one another in the colour of the pileus : pink, violaceous, purple and blue. Later on, var. *rosea* was distinguished, on account of morphological criteria (Maas Geesteranus, 1985, 1989), as a valuable specific entity named *M. rosea* Gramberg. This distinction was corroborated by isozyme patterns (Perreau & al., 1992).

At present time, *M. pura* is considered to be a very variable fungus (Corner, 1994) which is stated to be widespread throughout northern and southern (Horak, 1979) temperate regions and some tropical countries. In western Europe, seven colour forms were described beside the epithet *pura* (Maas Geesteranus, 1989). Only fruit-bodies which present a pale pink or lilaceous pink pileus and, additionally, those having lilaceous, lilaceous grey or, sometimes, deep violaceous cap, were examined for investigations on several isozymes activities.

According to the electrophoretic data, the form with pink-coloured pileus has proved to be genetically different from both the lilaceous form on one hand and *M. rosea* on the other hand. These results lead to the description of a new species, called *Mycena sororia,* which appears more closely related to *M. rosea* than to *M. pura sensu lato*.

Material and Methods

Material

One hundred twenty two basidiomata of *Mycena rosea,* 12 of pink (representing *M. sororia*) and 29 of lilaceous or violaceous forms of *M. pura* (29) were collected in Ile-de-France [Seine-et-Marne (77), Essonne (91)] and the neighbouring departments of Aisne (02) and Oise (60), during the autumns (October, November) 1992, 1993 and 1994. The specimens were gathered in humus and leaf-litter under beech (*Fagus silvatica* L.), beech mixed with oak (*Quercus robur* L.) or in coniferous woods (Tab.1)

Locality Forest or wood	Date	Numbers of basidiomata		
		M. rosea	*M. sororia*	*M. pura*
Fontainebleau (77)	1992	31	0	0
Fontainebleau (77)	1994	2	1	9
Fleury (91)	1993	0	0	5
Sénart (91)	1993	31	7	1
Hez (60)	1993	4	2	3
Coye (60)	1993	21	2	5
Coye (60)	1994	26	0	5
Laigue (02)	1994	7	0	1

Table 1 - Localities (names of the forests or woodlands) and number of specimens collected for each locality and species of *Mycena.*

Methods

Field collected basidiomata used for electrophoretic studies had reached maturity and were obviously at the same stage in their development.

Isolates were prepared from explants of basidiomatal tissue. Approximately 200-250 mg of tissue was ground with sand in 1 ml tris-glycine buffer (4.95 mM, pH 8.3) at 4° C, with 0.34 % mercaptoethanol, 1 % dimethyl sulfoxide, 7 mg polyvinyl pirrolidone and 150 mg saccharose. The homogenate was centrifuged at 16 000 *xg* for 15 min at 4° C and the supernatant solution was removed and stored at - 20° C before electrophoretic analysis (Boisselier-Dubayle & Bischler, 1989).

The extracts were run in vertical acrylamide gels (2.5 % stacking, 7 % migration) at 4° C, between glass plates 8 cm high and 0.75 mm thick (Hoefer apparatus), in a tris-glycine buffer (4.95 mM, pH 8.3), with 10 mA per slab.

Of the ten enzymes surveyed, six produced active and well-resolved bands. The enzyme staining solutions were prepared, just prior to the end of each run, as described below.

Esterase (EST, E.C. 3.1.1.1) : 97 ml 0.05 M Tris-HCl buffer pH 7.1; 100 mg Fast Blue RR salt; 3 ml 1 % αβ naphthyl acetate.

β glucosidase (GLU, E.C. 3.2.1.21) : 100 ml 6-bromo-2 naphthyl β-D-glucopyranoside solution (10 mg 6-bromo-2 naphthyl β-D-glucopyranoside; 20 ml methanol; 20 ml boiling water; 20 ml 0,2 M phosphate-citrate buffer pH 4.95; 40 ml H_2O); 20 ml 0.2 % tetra-azotized O-dianisidine solution.

Acid phosphatase (ACP, E.C. 3.1.3.2) : 100 ml 0.2 M acetate buffer pH 4.0; 50 mg α-naphthyl acid phosphate; 50 mg Fast Garnet GBC, 0.5 ml 10 % $MgCl_2$.

Isocitrate dehydrogenase (IDH, E.C. 1.1.1.42) : 60 ml 0.1 M Tris-HCl - 0.01M $MgCl_2$ pH 7.5; 80 mg isocitric acid; 15 mg NADP; 6 mg MTT; 3 mg PMS.

Glucose-6-phosphate dehydrogenase (G6PDH, E.C.1.1.1.49) : 100 ml 0.1 M Tris-HCl pH 7.0; 100 mg D-glucose 6 phosphate; 1 ml 1 M $MgCl_2$; 15 mg NADP; 15 mg NBT; 3 mg PMS.

Glutamate-oxaloacetate transaminase (GOT, E.C. 2.6.1.1) : 90 ml 0.1 M Tris-HCl buffer pH 8.5; 100 mg α-ketoglutaric acid ; 200 mg L-aspartic acid; ajusted to pH 8.5 with NaOH; 10 mg pyridoxal-5-phosphate; 150 mg Fast Blue BB salt.

In the description of fresh material, reference is made to the following colour codes respectively indicated as :

K - Klincksieck, P. and T. Valette, 1908. *Code des couleurs*. Paris, P. Klincksieck, 86 p.

M - Kornerup, A. and J.H. Wanscher, 1967. *Methuen Handbook of colour*. London, Methuen & C°, 2nd ed., 244 p.

R - Rayner, R.W., 1970. *A Mycological Colour Chart*. Surrey, Kew; Commonwealth Mycological Institute and British Mycological Society.

S - Séguy, E., 1936. *Code universel des couleurs. Encyclopédie Pratique du Naturaliste*. Paris, Lechevalier, 48 pl.

Results

Electrophoretic patterns

The electrophoretic analyses of six isozyme activities show that zymograms are differentiated into three main groups. They correspond to three groups among the collected basidiomata : those with pink pileus can be distinguished, on the one hand from those of the form with violaceous or lilaceous pileus of *M. pura* and, on the other hand, from those related to *M. rosea*. Moreover, this latter species has been previously separated from the complex *M. pura*, with the same methods (Perreau & al., 1992). The samples with pink pileate basidiomata, until now related to *M. pura* are named henceforth *Mycena sororia*.

Differences between the species of *Mycena* for three stainings are illustrated in Figure 1. For EST and ACP, *M. sororia* exhibits a very distinct zymogram. For IDH, the same two bands are revealed in all individuals of *M. rosea* (Boisselier-Dubayle & al., in press). Two bands that always exhibit slower migration, are also observed in *M. sororia* whereas only one band is revealed in *M. pura*.

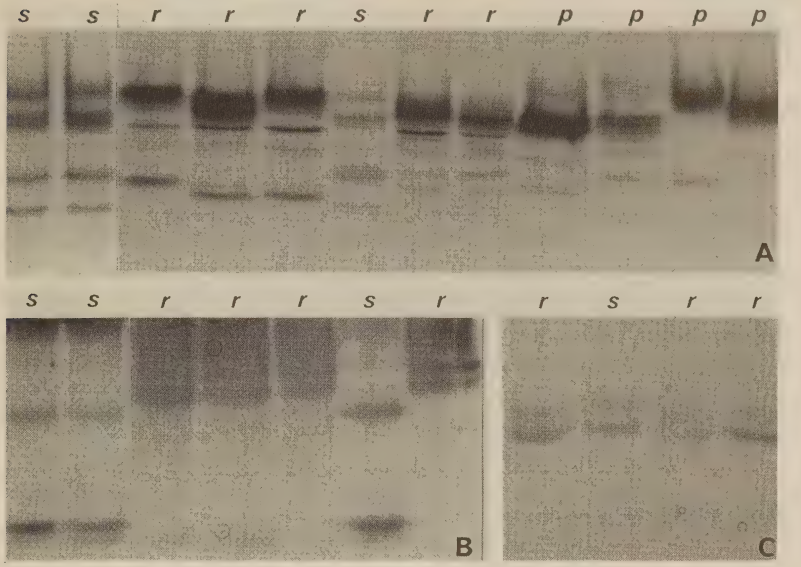


Figure 1 - Electrophoretic patterns of *Mycena sp.* (**s** : *M. sororia*; **r** : *M. rosea*; **p** : *M. pura*) for esterase (**A**), acid phosphatase (**B**) and isocitrate dehydrogenase (**C**) activities.
A and **B** : samples of *M. sororia* from Sénart are on the left, the others came from Fontainebleau; **C** : the sample of *M. sororia* came from Coye.

Electrophoretic changes are also observed for the three other stainings. For GLU, one locus is revealed in the *Mycena* of the section *Calodontes*. Two alleles are scored in *M. rosea* (Boisselier-Dubayle & al., in press), whereas *M. sororia* appears monomorphic. In this species, the allele exhibits a faster migration than those found in *M. rosea*. As for GLU, only one locus is recorded for GOT; the electromorph of *M. sororia* being of slower migration than those detected in *M. rosea* and *M. pura*. G6PDH shows only one region of activity : the electromorphs of *M. sororia* are nearly similar to those of *M. rosea* but with a slower migration. Patterns of *M. pura* appear different in mobility and intensity of bands.

Isozyme patterns of *Mycena sororia* appear therefore to be specific, revealing nevertheless a certain affinity with *M. rosea* for IDH and G6PDH. No noticeable variation was found among the electrophoretic patterns of the 12 analyzed basidiomata. Indeed, electromorphs of the specimens from the four forests and from two years are identical.

Morphological characteristics

The specific status of *Mycena sororia*, well supported by isozyme characterization, is corroborated by some macro- and microscopical observations. The distinctive morphological characteristics of *M. sororia* in comparison with *M. pura* are mainly the lilaceous to whitish pink colour of the pileus and the larger size of the basidiospores. Compared with *M. rosea*, the cylindrical or fusiform outline of the stipe and the non-spheropedunculate cheilocystidia are the most significant distinctive features. The shape and size of the cheilocystidia, the presence or not of pleurocystidia are important distinctive criteria also in other species of Mycenas of the subsection *Purae* (Raithelhuber, 1980).

Description (Fig. 2)

Mycena sororia Perreau, Boisselier & Lambourdière, *sp. nov.*

Pileus 25-50 mm latus, campanulatus, convexus vel plano-convexus, centro umbonatus, circum umbone concentrico-sulcatus, translucente striatus, hygrophanus, lilaceo-roseus, pallidior, centro flavescente. Caro tenuis, pallida, odore raphanoidei. Lamellae 38-42 stipitem attingentes, usque ad 5 - (7.5) mm latae, sinuato-adnatae, albo-rosae, margine convexo, pallidiore. Stipes 70-95 x 4-6 mm, cavus, cylindraceus vel fusiformis, levis, pallide roseo-albus deinde lilacino-roseus vel purpureo-lilaceus, fibrillis sparsis basi instructus.

Basidia 30-35 x 5-6 μm, clavata, 4-sporigera, fibulata, sterigmatibus 6-7 longis munita. Sporae 7.5-8.5-10 x 4.5-5.5 μm, inaequilateriter ellipsoideae, laeves, amyloideae. Cheilocystidia 50-75 x 10-18 x 6-7 μm, claviformia vel fusiformia, fibulata, levia. Pleurocystidia similia, longiora, ad 20 μm diametro. Trama lamellarum iodi ope vinescens. Hyphae pileipellis 2-5μm latae, fibulatae, leves. Hyphae stipitis corticales fibulatae, leves, cellulae terminales 6-10 μm latae, claviformae vel fusiformiae.

In nemore frondoso, ad terram, inter Fagus silvaticae vel Quercus sp. folia dejecta.

Holotypus : J. Perreau , 94-339 (PC).

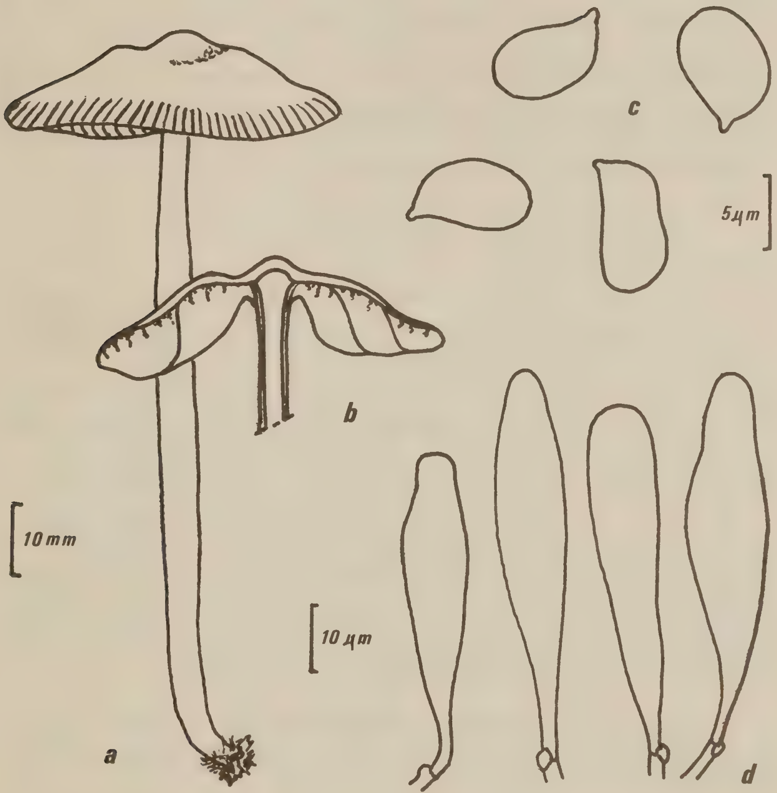


Figure 2 - *Mycena sororia* (Perreau, 94-339, holotype). Basidiomata - ***a*** : habitus; ***b*** : longitudinal section; ***c*** : spores; ***d*** : cheilocystidia.

Basidiomata solitary or in small groups. Pileus up to 25-45-50 mm in diameter, campanulate to convex, then expanded, with concentric depression around an obtuse conical - sometimes flattened - umbo, shallowly rugose, translucent-striate, hygrophanous, lilaceous pink [**K** 591/592; **M** 12 A 5; **R** 1, 58; **S** 15, 85, 664], "Aurora" pink, whitish pink, pallescent with age [**K** 3 C, 53 C, 0121; **M** 11 A 3; **R** 61; **S** 49, 254], often pale yellowish to yellowish pink at the centre; margin concolorous. Flesh thin, whitish or light pinkish, with weak raphanoid odour. Lamellae 38 - 42 reaching the stipe, tender, ascending then almost horizontally, ventricose, up to 5 (7. 5) mm broad, sinuate-adnate, dorsally intervenose, pale pink [**K** 578 B; **S** 70, 665], the edge convex, sometimes slightly denticulate, whitish. Stipe 70-95 x 4-6 mm, cylindrical or fusiform, not widened below, terete or a little compressed, hollow, firm to brittle, smooth or finely striate, whitish with pink and yellowish tint to lilaceous or purplish pink [**K** 28 A, 592; **M** 11 A 3, 12 C 4; **R** 127; **S** 19, 55, 690], the base sometimes covered with fibrils bringing together dead leaf-fragments.

Electrophoretically well characterized by EST, ACP, GLU, GOT, IDH and G6PDH.

Basidia 30-35 x 5-6 µm, clavate, tetra- (occasionally two- or tri-) spored, clamped, with sterigmata up to 6-7 µm long. Spores 7.5-8.5-10 x 4.5-5.5 µm, pip-shaped, smooth, amyloid. Cheilocystidia 50-75 x 10-18 x 6-7 µm, forming a sterile band (lamellar edge homogeneous), smooth, clavate, subcylindrical , sometimes apically broadly rounded or attenuated, fusiform, long-stalked, clamped. Pleurocystidia numerous, similar, often longer (80-90 µm), up to 20 µm in diameter. Lamellar trama vinescent in Melzer's reagent. Hyphae of the pileipellis 2-5 µm wide, clamped, smooth. Pigment vacuolar. Hyphae of the cortical layer of the stipe 2-5 µm wide, clamped, smooth, terminal cells (caulocystidia) 40-100 x 6-10 µm, simple, claviform, fusiform, sometimes apically capitate, smooth.

In leaf-litter, under beech and/or oak (*Fagus silvatica*, *Quercus sp.*), associated with *M. rosea*, but apparently less common. So far, not found under coniferous trees.

Etymology : *sororius, -a* (*soror*), of sister, alluding to the affinity with *M. rosea*.
Holotype : France, Seine-et-Marne, Forêt de Fontainebleau, Route de la Tour Dénecourt, 13. 11. 1994, *J. Perreau N° 94-339* (PC).
Collections examined. France : Forêt de Sénart (91), 03. 10. 1993, *J. Perreau 93-200, 205, 206, 207, 208, 213, 214*; Forêt de Coye (60), 10. 10. 1993, *J. Perreau 93-277, 279*; Forêt de Hez (60), 24. 10. 1993, *J. Perreau 93-389, 391.*

Conclusion

Stable in several isozyme activities, *M. sororia* is rather invariable in its morphological characters and in colour - pink with lilaceous shade - of the pileus, only faintly yellowish or pallescent with age and in dry conditions. It may partly represent f. *pura* of *M. pura* described with "concentric depression round the umbo" of the pileus (Maas Geesteranus, 1989). It is also not unlike to f. *roseoviolacea* (Gillet) Maas Geest. of the same taxon, a form that has a pileus with dingy or violaceous tints. Nevertheless, the species studied here can not be assigned to *M. pura*, often described with lilaceous, grey lilaceous, violaceous or purple basidiomata and smaller spores (6.2-7 x 3-4 µm), growing not only in deciduous forests but also under coniferous trees.

Mycena sororia has biochemichal affinities to *M. rosea*, an enzymatically well defined species with distinctive morphological characters as stated by Maas Geesteranus. Often found in the same habitat, probably mistaken for *M. rosea* when it is not named *M. pura*, *M. sororia* differs from the first taxon by the more violaceous pink colour of the pileus which is also more dry in touch, and by the pinkish white to purplish pink stipe, cylindraceous or fusiform, not widened at the base; moreover it presents spores which are somewhat larger (7.5-8.5-10 x 4.8-5.5 µm) than those of *M. rosea* (6.5-9 x 4.5-5 µm) with spheropedunculate cheilocystidia.

On the other hand, the relationships between *M. sororia* and the caespitose *M. auroricolor* (Berk. & Br.) Petch described from Sri Lanka (Pegler, 1986) and mentioned as a member of the subsection *Purae* (Maas Geesteranus, 1992) are unknown. The habit and colour of the basidiomata seem similar in both *M. sororia* and *M. auroricolor*. Nevertheless, in this latter species, the spores appear to be smaller and pleurocystidia are absent. A comparison of fresh collections would be required for a better separation of these two Mycenas originating from geographically distant countries.

Two biological taxa inside *Mycena pura* with pink pileus are therefore distinguished. *M. pura sensu lato*, with its wide range in colour and diversity in microscopical characteristics, has still to be regarded as a complex of morphologically similar species. A revision of this artificial entity and of its world distribution is now desirable. In particular, further investigations are needed to test identity of specimens from temperate and tropical origin (Corner, 1986, 1994; Maas Geesteranus & Horak, 1995).

Acknowledgements

The authors express their gratitude to Dr. H. Bischler (C.N.R.S., Museum, Paris) for helpful suggestions and improvements in writing this paper and to Prof. Dr. E. Horak (E.H.T., Zürich) for constructive comments and critically reviewing the manuscript. They also thank M. Dumont-Vialatte (Museum, Paris) for the photographic prints.

LITERATURE CITED

Blaich, R., 1977. Enzymes as an aid in taxonomy of higher basidiomycetes. *In* : The Species Concept in Hymenomycetes (Clémençon, H., ed.). Proc. Herbette Symp., Lausanne, Switzerland, 1976. - *Biblioth. Mycol.* **61** : 215-228.

Boisselier-Dubayle, M.C., 1983. Taxonomic significance of enzyme polymorphism among isolates of *Pleurotus* (Basidiomycetes) from umbellifers. *Trans. Brit. Mycol. Soc.* **81** 121-127.

Boisselier-Dubayle, M.C. and **H. Bischler,** 1989. Electrophoretic studies in *Marchantia polymorpha* L. *J. Hattori Bot. Lab.* **67** : 297-311.

Boisselier-Dubayle, M.C., J. Perreau-Bertrand and **J. Lambourdière,** in press. Genetic variability in wild populations of *Mycena rosea* Gramberg (*Basidiomycotina*). *Mycol. Res.*

Corner, E.J.H., 1986. The tropical complex of *Mycena pura*. *Bot. Soc. Edinburgh, Transactions, 150 th Anniv., suppl.* : 61-67.

Corner, E.J.H., 1994. Agarics in Malesia. I Tricholomatoid - II Mycenoid. *Nova Hedwigia* **109** : 196-200.

Horak, E., 1979. Fungi, Basidiomycetes, Agaricales y Gasteromycetes secotioides. *Fl. Criptog. Tierria del Fuego* **11** : 1-525.

Lin, D., M.T. Dumas and **M. Hubbes,** 1989. Isozyme and general protein patterns of *Armillaria spp*. collected from the boreal mixedwood forest of Ontario. *Canad. J. Bot.* **67** : 1143-1147.

Maas Geesteranus, R.A., 1985. Studies in Mycenas 148-167. *Proc. Kon. Ned. Akad. Wetensch., C* **88** : 47-62.

Maas Geesteranus, R.A., 1989. Conspectus of the Mycenas of the Northern Hemisphere , 13. Sections *Calamophilae* and *Calodontes*. *Proc. Kon. Ned. Akad. Wetensch., C* **92** : 477-504.

Maas Geesteranus, R.A., 1992. Some *Myceneae* of the Himalayan foothills. *Persoonia* **15** : 33-53.

Maas Geesteranus, R.A. and **E. Horak,** 1995. *Mycena* and related genera from Papua New Guinea and New Caledonia. *Biblioth. Mycol.* **159** : 143-229.

Micales, J.A., M.R. Bonde and **G.L. Peterson,** 1986. The use of isozyme analysis in fungal taxonomy and genetics. *Mycotaxon* **27** : 405-449.

Molitoris, H.P. and **H. Prillinger,** 1986. Isoenzyme spectra for characterization and identification of fungi (influence of genetical and nongenetical factors). *Mycol. Helvet.* **2** : 103-122.

Pacioni, G. and **G. Pomponi**, 1991. Genotypic patterns of some Italian populations of the *Tuber aestivum* - *T. mesentericum* complex. *Mycotaxon* **42** : 171-179.

Pacioni, G., G. Frizzi, M. Miranda and **C. Visca,** 1993. Genetics of a *Tuber aestivum* population (*Ascomycotina, Tuberales*). *Mycotaxon* **47** : 93-100.

Pegler, D.N., 1986. Agaric Flora of Sri Lanka. *Kew Bull., Addit. Ser.* **12** : 1-519.

Perreau, J., J. Lambourdière and **M.C. Boisselier,** 1992. *Mycena rosea* et le complexe *Mycena pura*. *Cryptogamie, Mycol.* **13** : 247-251.

Raithelhuber, J., 1980. Der Arten- und Formenkreis um *Mycena pura* (Pers. *ex* Fr.) Kumm. *Metrodiana* **9** : 26-40.

Royse, D.J. and **B. May,** 1982. Use of isozyme variation to identify genotypic classes of *Agaricus brunnescens*. *Mycologia* **74** : 93-102.

Shannon, M.C., S.K. Ballal and **J.W. Harris,** 1973. Starch gel electrophoresis of enzymes from nine species of *Polyporus*. *Amer. J. Bot.* **60** : 96-100.

Yoon, C.S., R.V. Gessner and **M.A. Romano,** 1990. Population genetics and systematics of the *Morchella esculenta* complex. *Mycologia* **82** : 227-235.

Zervakis, G., J. Sourdis and **C. Balis,** 1994. Genetic variability and systematics of eleven *Pleurotus* species based on isozyme analysis. *Mycol. Res.* **98** : 329-341.

MYCOTAXON

Volume LX, pp. 275-281 October-December 1996

NOTES ON CONIDIAL FUNGI. X. A NEW SPECIES OF *CERATOSPORELLA* AND SOME NEW COMBINATIONS

R. F. Castañeda Ruiz[1], J. Guarro[2], J. Cano[2]

[1] Instituto de Investigaciones Fundamentales en Agricultura Tropical "Alejandro Humboldt" (INIFAT) Calle 1 esq. 2 Santiago de las Vegas, Ciudad Habana, Cuba. [2] Unitat de Microbiologia, Facultat de Medicina i Ciències de la Salut, Universitat Rovira i Virgili, 43201 Reus, Tarragona, Spain

ABSTRACT

Ceratosporella compacta anam. sp. nov., found on a decaying stem of an unidentified member of the Poaceae, is described and illustrated. It is distinguished by its compact, dark brown to black conidia with 4 - 5 arms closely appressed. Each arm ends in a short, robust appendage toward the apex, sometimes with a mucilaginous tunica. Some species hitherto described in *Ceratosporella* are recombined.

Key words:*Ceratosporella, Acrodictys, Actinocladium, Arachnophora, Triposporium*, hyphomycetes, systematics, tropical fungi

RESUMEN

Se describe e ilustra *Ceratosporella compacta* anam. sp. nov., aislada sobre restos de hojas de una especie no identificada de Poaceae. Se distingue por sus conidios compactos, de color pardo oscuro a negro, con 4 - 5 brazos estrechamente agrupados. De cada extremo del brazo emergen cortos y robustos apéndices con una envoltura mucilaginosa. Algunas especies anteriormente descritas en *Ceratosporella* son reclasificadas.

Palabras clave: *Ceratosporella, Acrodictys, Actinocladium, Arachnophora, Triposporium*, systematics, tropical fungi

Ceratosporella compacta Castañeda Ruiz, Guarro et Cano anam. sp. nov. (Fig. 1,2)

Ad fungos conidiales, hyphomycetes pertinens. ***Coloniae*** *effusae, nigrae. Mycelium partim superficiale et partim in substrato immersum, ex hyphis septatis, ramosis, laevibus, atrobrunneis, 2 µm diam compositum.* ***Conidiophora*** *conspicua, mononematosa, eramosa, erecta, recta, cylindrica vel subulata, leviter inflata ad basim, 0 - 2 septata, levia, nigra, 18 - 48 x 6 - 10 µm.* ***Cellulae conidiogenae*** *monoblasticae, terminales, interdum percurrentes, cylindricae, in conidiophoris incorporatae.* ***Conidia*** *cheiroidea, compacta, acrogena, solitaria, levia, atrobrunnea ad basim, brunnea ad apicem, ex cellula basalis et quator vel quinque ramulis composita; cellula basalis cylindrica, truncata, nigra vel atrobrunnea, levia, 5 - 8 x 5 - 7 µm; ramuli plus minusve cylindrici ad basim, attenuati ad apicem, curvati, adpressi, 12 - 14 septati, 65 - 70 µm longi et 4 - 5 µm crassi (appendice exclusa), insidentes ad basim et apicem, sed leviter divergentes mutati in appendicibus cellularis. Appendicibus cylindricis, inflatis et rotundatis ad apicem, 2 - 6 septatis, 15 - 46 x 2.5 - 4 µm, brunneis, pallide brunneis ad apicem, robustis, ex interdum tunica mucosa, 6-12 µm diam ad apicem praeditus. Teleomorphosis ignota.*

Conidial fungi, hyphomycetes. **Colonies** effuse, black. Mycelium superficial and immersed. Hyphae septate, branched, smooth, dark brown, 2 µm diam. **Conidiophores** differentiated, mononematous, simple, erect, straight, cylindrical or subulate, slightly inflated at the base, 0 - 2 septate, smooth, black, 18 - 48 x 6 - 10 µm. **Conidiogenous cells** monoblastic, terminal, cylindrical, integrated, sometimes percurrent. **Conidia** cheiroid, acrogenous, solitary, smooth-walled, dark brown at the base, brown at the apex; composed of a basal cell and 4 - 5 arms; basal cell cylindrical, truncate, black or dark brown, smooth, 5 - 8 x 5 - 7 µm; arms more or less cylindrical, attenuate toward the apex, curved, appressed, 12 - 14 septate, 65 - 70 x 4 -5 µm (appendage excluded), slightly divergent toward the base and the apex, but concurrently turning progressively into cellular appendages in apical region; appendages cylindrical, inflated and rounded at the apex, robust, 2 - 6 septate, 15 - 46 x 2.5 - 4 µm, pale brown, sometimes with a slimy tunica of 6 - 12 µm diam at the apex. Teleomorph unknown.

Holotype: INIFAT C94/162, on fallen decaying stem of unidentified member of the Poaceae, Viñales, Pinar del Río, Cuba,11 November 1994, R. F. Castañeda. Isotype: MUCL 39130 (Mycotheque Universite Catholique de Louvain). Cultures ex type: INIFAT C94/162, CBS 184.95 and MUCL 39130.

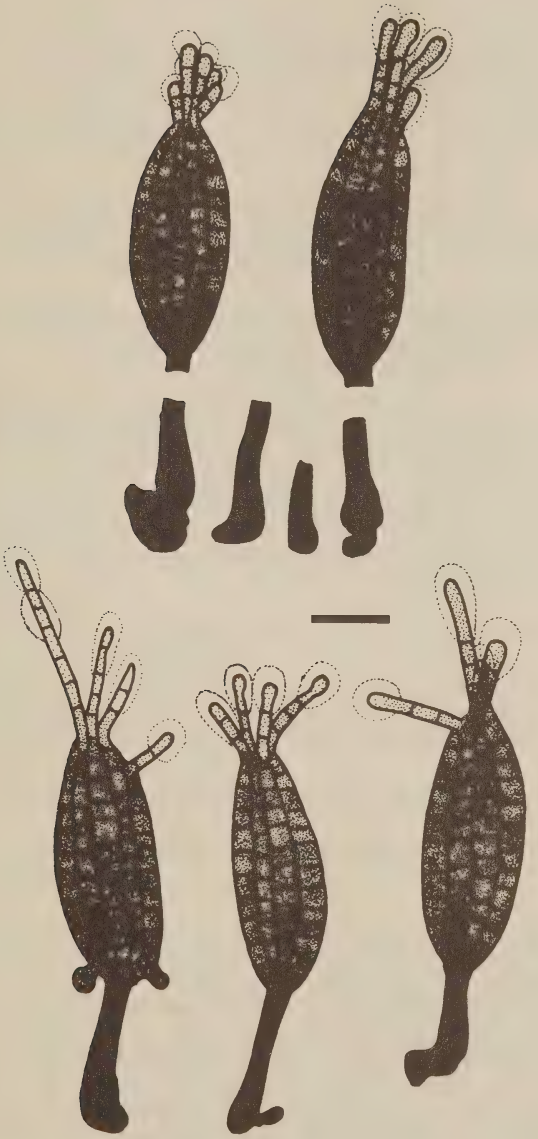


Fig.1- *Ceratosporella compacta* (INIFAT C94/162). Conidiophores and conidia (bar = 20 µm)

Among the previously described species of *Ceratosporella*, only *C. stipitata* (Goidànich) S.J.Hughes (1952), *C. caliculata* Lutrasti (1980); *C. ponapensis* Matsushima (1981) and *C. fertilis* Castañeda Ruiz (1985) resemble *C.compacta* superficially. However, *C. stipitata* has arms up to 130 µm long and 6 - 9 µm thick, without appendages; *C. caliculata* has 6 - 7 septate arms and a verrucose outer wall; *C. ponapensis* has 4 - 7 arms up to 120 µm long and lacks appendages and *C. fertilis* has usually 8 - 10 arms, 33 - 60 µm long, usually without appendages.

Ceratosporella deviata Subramanian (1957) has stauroconidia which strongly resemble *Triposporium* Corda, especially with *T. elegans* Corda (Ellis 1971), as suggested by Sinclair et al. (1987); and the following new combination is proposed:

Triposporium deviatum (Subramanian) Castañeda Ruiz, *comb. nov.*
Basionym: *Ceratosporella deviata* Subramanian in Proceeding of the Indian Academy of Sciences, Sect. B 46: 327 (1957).

Two species of *Ceratosporella, C. longiramosa* Castañeda Ruiz (1988) and *C. pulneyensis* Subramanian & Bhat (1987) lack cheiroid conidia. The first has stauroconidia with 3 divergent, distoseptate, 65 - 160 µm long arms and which would be better classified in *Actinocladium* Ehrenb.: Pers. The latter has stellate conidia with two cells, each bearing 2 divergent arms, 14 x 3 - 5 µm. It should be classified in *Arachnophora* Hennebert (1963). Hence the following new combinations are proposed:

Actinocladium longiramosum (Castañeda Ruiz) Castañeda Ruiz, *comb. nov.*
Basionym: *Ceratosporella longiramosa* Castañeda Ruiz in Fungi Cubenses III, Instituto de Investigaciones Fundamentales en Agricultura Tropical "Alejandro de Humboldt", p 2 (1988) Cuba

Arachnophora pulneyensis (Subramanian & Bhat) Castañeda Ruiz, *comb. nov.*
Basionym: *Ceratosporella pulneyensis* Subramanian & Bhat in Kavaka 15: 50 (1987)

Ceratosporella lambdaseptata Matsush. (1971) has stauroconidia with 3-4 radial arms and has been placed in *Triposporium* by Kuthubutheen and Nawawi (1991), and *Ceratosporella goidanichii* Rambelli (1958) has cylindrical conidia without arms and has been relocated in *Sporidesmium* by Hughes (1979). Other previously described *Ceratosporella* spp. are: *C. bicornis* (Morgan) Höhnel (Ellis 1971), *C. novae-zelandiae* S.J. Hughes (1971), *C. cheiroidea* Sinclair, Morgan-Jones & Eicker (1987), *C. disticha* Kuthubutheen & Nawawi (1991), *C. basibicellularia* Matsush. (1993), *C. basicontinua* Matsush. (1993) and *C. flagellifera* Matsush. (1993). *Acrodictys furcata* Ellis (1963) has cheiroid conidia which resemble *C. novae-zelandiae* and could be classified as *Ceratosporella*, but no new combination is proposed.

We propose the following key for the identification of *Ceratosporella* species:

KEY TO SPECIES OF *CERATOSPORELLA*

1. Conidia smooth-walled.. 2
1'. Conidia verrucose, with 4 arms. Arms 6-7 septate,
    28 - 44 x 4 - 6 µm.. *C. caliculata*

  2. Conidia with 2 divergent arms forming angles
      wider than 45^{0}. Arms 5 - 7 septate, 50 - 80 x 9 - 13 µm *C. bicornis*
  2'. Conidia with no divergent arms 3

3. Conidia usually with more than 4 arms.................................. 4
3'. Conidia usually with 4 or less arms....................................... 6

  4. Conidial arms 65 - 70 µm long, 12 - 14 septate
      and with appendages.. *C. compacta*
  4'. Conidial arms shorter than 65 µm 5

5. Conidia with 5 - 8 arms. Arms 4 - 8 septate,
    22 - 38 µm long... *C. ponapensis*
5'. Conidia with 8 - 12 Arms. Arms 7 - 14 septate,
    38 - 60 µm long... *C. fertilis*

  6. Conidia with apical appendages 7
  6'. Conidia without appendages 8

7. Conidia with septate appendages;
    arms with 5 - 8 septa .... *C. flagelligera*
7'. Conidia with non-septate appendages;
    arms with 8 - 10 septa .... *C. disticha*

  8. Conidia with the basal cell darker than the rest .... *C. cheiroidea*
  8'. Conidia not as above 9

9. Conidia usually with 3 - 4 arms, 6 - 8 µm wide........................ *C. stipitata*
9'. Conidia always with 2 arms.. 10

  10. Basal part of the conidia 1-septate;
       conidial arms 2 - 6 septate .... *C. basibicellularia*
  10'. Basal part of the conidia aseptate.................................... 11

11. Conidial arms emerging symmetrically from
     the basal cell, 1 - 5 septate .... *C. basicontinua*
11'. Conidial arms emerging asymmetrically from
     the basal cell (one of them in lateral position), 1 - 3 septate,
     slightly constricted at the septa.. *C. novae-zelandiae*

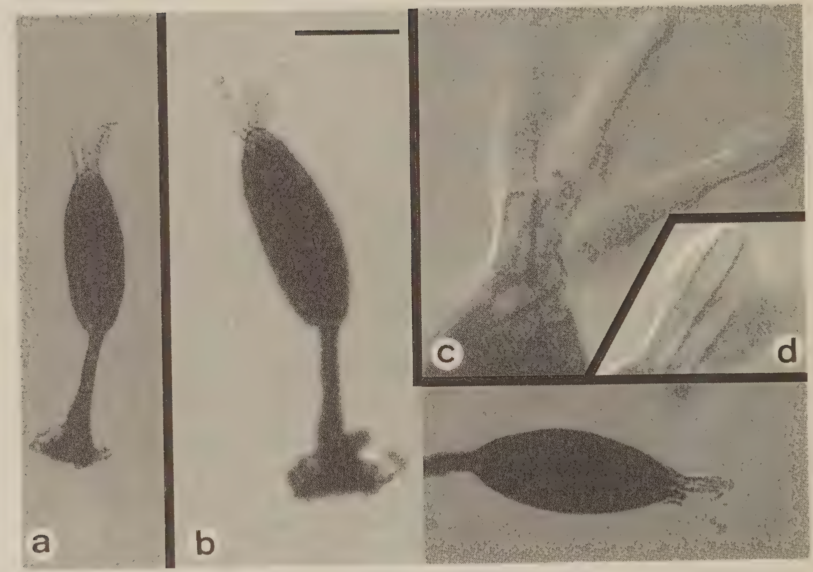


Fig.2- *Ceratosporella compacta* (INIFAT C94/162). **a,b,** conidiophores and conidium; **c,d,** cellular appendages (bar: **a** = 40 µm, **b** = 25 µm, **c,d,** = 10 µm).

ACKNOWLEDGEMENTS

We gratefully acknowledge Dr. E. Descals (Inst. Mediterrani d' Estudis Avançats de les Balears, C.S.I.C.) for serving as pre-submission reviewers, The Cuban Ministry of Agriculture for facilities during this work. This work was supported the "Fundación Ciencia i Salut", Reus, Spain.

REFERENCES

Castañeda Ruiz, R.F. (1985). Deuteromycotina de Cuba. Hyphomycetes.II. Instituto de Investigaciones Fundamentales en Agricultura Tropical "Alejandro de Humboldt", Cuba, 23 pp.

Castañeda Ruiz, R.F. (1988). Fungi cubenses III. Instituto de Investigaciones Fundamentales en Agricultura Tropical "Alejandro de Humboldt", Cuba, 54 pp.

Ellis, M. B. (1963). Dematiaceous Hyphomycetes. V. *Mycol. Pap.* **93**: 1-33.

Ellis. M. B. (1971). Dematiaceous Hyphomycetes. Commonth. Mycol. Inst., Kew, 608 pp.

Hennebert, G.L. (1963). Un hyphomycete nouveau, *Arachnophora fagicola* gen. nov., sp. nov. *Can. J. Bot.* **41**: 1165-1169.

Hughes, S.J. (1952). *Speira stipitata. Trans. Brit. Mycol. Soc.* **35:** 243-247.

Hughes, S.J. (1971). New Zealand Fungi 16. *Brachydesmiella, Ceratosporella.* *N. Z. J. Bot.* **9**: 351-354.

Hughes, S.J. (1979). Relocation of species of *Endophragmia* auct. with notes on relevant generic names. *N. Z. J. Bot.* **17**: 139-188.

Lustrati, L. (1980). *Ceratosporella caliculata*, sp. nov. nuova specie di ifale demaziaceo. *Mic. Ital.* **3**: 11-14.

Kuthubutheen, A. J. & Nawawi A. (1991). A new species of *Ceratosporella* and *Triposporium lambdaseptatum* (Matsush.) comb. nov. from Malaysia. *Mycol. Res.* **95**: 158-162.

Matsushima, T. (1971). Microfungi of the Solomon Islands and Papua-New Guinea, Kobe. Matsushima.

Matsushima, T. (1981). Matsushima Mycological Memoirs No.2, Kobe. Matsushima.

Matsushima, T. (1993). Matsushima Mycological Memoirs *No.7*, Kobe. Matsushima.

Rambelli, A. (1958). Micromiceti della Foresta di Campigna. *11^0 Contributo. Atti Accad. Scienze Ist. Bologna, cl. Sci. Fis., ser.XI,* **5**:1-15.

Sinclair, R. C., Eicker, A. & Morgan-Jones G. (1987). Notes on : Hyphomycetes. LVI. *Ceratosporella cheiroidea*, a new species. *Mycotaxon* **30**: 351-355.

Subramanian, C. V. (1957). Hyphomycetes IV. *Proc. Indian Acad. Sci., sect.B,* **46**: 324-335.

Subramanian, C. V. & Bhat, D.J. (1987). Hyphomycetes from South India I. Some new taxa. *Kavaka,* **15**: 41-74.

MYCOTAXON

Volume LX, pp. 283-290 October-December 1996

SOME AIRBORNE CONIDIAL FUNGI FROM CUBA

R.F. Castañeda Ruíz[1], D.E. Fabré[2], M.P. Parra[2], M. Pérez[2], J. Guarro[3]

and J. Cano[3]

[1]Instituto de Investigaciones Fundamentales en Agricultura Tropical "Alejandro de Humboldt" (INIFAT) Calle 1, esq. 2 Santiago de las Vegas. Ciudad Habana. Cuba. [2]Hospital Pediátrico Docente "Juan Manuel Márquez" Avenida 31. Marianao, Ciudad Habana, Cuba. [3]Unitat de Microbiologia, Facultat de Medicina i Ciències de la Salut, Universitat Rovira i Virgili. 43201 Reus, España

ABSTRACT

Zeloasperisporium hyphopodioides anam. gen. et sp. nov. is described and illustrated from conidia in the atmosphere of Cuba. This fungus is distinguished by the short and clearly differentiated hyphopodia arising from vegetative hyphae and 0-2 septate, verrucose conidia arising from sympodial conidiogenous cells. Seven other species of hyphomycetes are cited from the same source.

Key words: Aeromycology, *Zeloasperisporium hyphopodioides*, hyphomycetes, Cuba

RESUMEN

Se describe e ilustra *Zeloasperisporium hyphopodioides anam. gen. et sp. nov.* aislado de conidios en la atmósfera de Cuba. Dicho hongo se caracteriza por la formación de hifopodios cortos y bien diferenciados a partir de las hifas vegetativas y por poseer conidios 0-2 septados y verrucosos formándose sobre células conidiógenas simpodiales. Otras siete especies de hongos conidiales aislados también del aire de Cuba son citadas.

Palabras clave: *Aeromycology, Zeloasperisporium hyphopodioides,* hyphomycetes, Cuba

INTRODUCTION

During December 1992, January-February 1993, and October-November 1994, a survey of airborne fungi possibly related to asthmatic and allergic diseases was conducted in Cuba. Air samples were collected from 3 localities in Havana City Province (Marianao, Playa and Cerro). In this paper only new and uncommon conidial fungi are treated.

MATERIAL AND METHODS

Colonies were obtained on gravity exposed plates. Three plates were exposed daily and simoultaneously for 15 minutes in and out of three different homes in three different areas of Havana City Province. The culture medium used was SNA (Nirenberg, 1976), with 300 ppm chloramphenicol. The plates were incubated at 25 ± 2 °C for four days. Some strains were subcultured on leaf litter during four weeks, according to Nag Raj (1993). A more complete description of the method and analysis of the data will be given in a later paper.

TAXONOMIC PART

Zeloasperisporium Castañeda Ruíz *anam. gen. nov.*
Etym.: Zelo-, from the Greek, meaning emulation; -asperisporium, a genus name in the Fungi.

Hyphomycetes pertinens. Coloniae effusae, olivaceae usque brunneae. Mycelium plerumque superficiale. Hyphae septatae, brunneae usque olivaceae. Hyphopodia brevissima, "appressoria" similia, tuberculata usque lobata ad apicem, saepissime adsunt. Conidiophora conspicua, mononematosa, erecta, septata, brunnea usque olivacea, eramosa. Cellulae conidiogenae polyblasticae, sympodiales, integratae, cicatricatae cum cicatricibus conspicuis praeditae. Conidia obclavata vel clavata, fusiformia usque cylindrica, cicatricata, septata, levia vel verrucosa, olivacea usque brunnea.
Species typica: ***Zeloasperisporium hyphopodioides*** *anam. sp. nov.*

Hyphomycetes. Colonies on natural substrate effuse, olivaceous to brown. Mycelium mostly superficial. Hyphae septate, brown to olivaceous. Hyphopodia short, appressorium-like, inflated, slightly warted to lobed at the apex, present. Conidiophores differentiated, mononematous, erect, septate, brown to olivaceous, unbranched. Conidiogenous cells polyblastic, sympodial, terminal, integrated, with evident dark detachment scars. Conidia obclavate, clavate, fusiform, or cylindrical, septate, verrucose or smooth, olivaceous to brown, scarred.

Zeloasperisporium shows some resemblance with *Passalora* Fries, *Asperisporium* Maublanc, and *Fusicladium* Bonorden (Ellis 1971, 1976; v. Arx 1983,1987). All have blastic conidiogenesis and sympodial, terminal, cicatrized conidiogenous cells; and obclavate, cylindrical to fusiform or obovoid conidia. However, vegetative hyphae in *Passalora* are immersed in the host tissue and form pseudoparenchymatous stromata, whereas in *Asperisporium* and *Fusicladium* the hyphae form well-developed, erumpent stroma. Hyphopodia are only present in *Zeloasperisporium*

Zeloasperisporium hyphopodioides Castañeda *anam. sp. nov.* Figs. 1,2

Ad hyphomycetes pertinens. Coloniae in foliis putridis sterilifactis Bucidae palustris, effusae, amphigenae, olivaceae. Mycelium plerumque superficiale. Hyphae septatae, ramosae, plerumque verrucosae, interdum leves, brunneae usque olivaceae, 3.5 mm diam, Hyphopodia brevissima "appressoria" similia, cylindrica, 2.5 - 4.5 x 1 - 1.5 μm, inflata, leviter tuberculata usque lobata ad apicem, pallide olivacea et obscura ad apicem, 2.5 - 4 x 1 - 1.5 μm, interdum numerosa, saepissimae adsunt. Conidiophora conspicua, mononematosa, subulata, erecta, recta, 0 - 1 septata, levia vel leviter verrucosa, brunnea vel olivacea, eramosa, usque 40 μm alta et 3.5 - 4.5 μm crassa ad basim. Cellulae conidiogenae polyblasticae, sympodiales, integratae, cicatricatae cum cicatricibus obscuris, conspicuis praeditae. Conidia obclavata, conico-truncata, ad basim cicatricata, obtusa ad apicem, 0-2 (1) septata, constricta ad septum, verrucosa, olivacea vel brunneo-olivacea, sicca, 16 - 25 x 3 - 4 μm. Teleomorphosis ignota.

Hyphomycetes. Colonies on sterilized leaves of *Bucida palustris* effuse, amphigenous, olivaceous. Mycelium mostly superficial. Hyphae septate, branched, verrucose, sometimes smooth, brown to olive, 2 - 3 mm diam. Hyphopodia short, cylindrical, inflated, slightly warted to lobed at the apex, pale olive, darker at the end, 2.5 - 4 x 1 - 1.5 μm, sometimes numerous. Conidiophores differentiated, mononematous, subulate, erect, straight, 0-1 septate, smooth-walled or slightly verrucose, brown to olive, unbranched, up to 40 μm tall, 3.5 - 4.5 μm wide at the base. Conidiogenous cells polyblastic, sympodial, terminal, integrated, with conspicuous dark scars. Conidia obclavate, obconical truncate at the base, scarred, obtuse at the apex, 0-2 (1) septate, constricted at the septa, verrucose, olive or brown-olivaceous, dry, 16 - 25 x 3 - 4 μm. Teleomorph unknown.

Type specimen: On sterilized leaves of *Bucida palustris*, C. Havana. Cuba, R.F. Castañeda, 4 October. 1994. Holotype: INIFAT C94/114, in INIFAT Herbarium, Havana, Cuba. Isotype: CBS 257.95. Living cultures ex type: INIFAT C94/114, CBS 218.95, MUCL 39155 and IMI 367520.

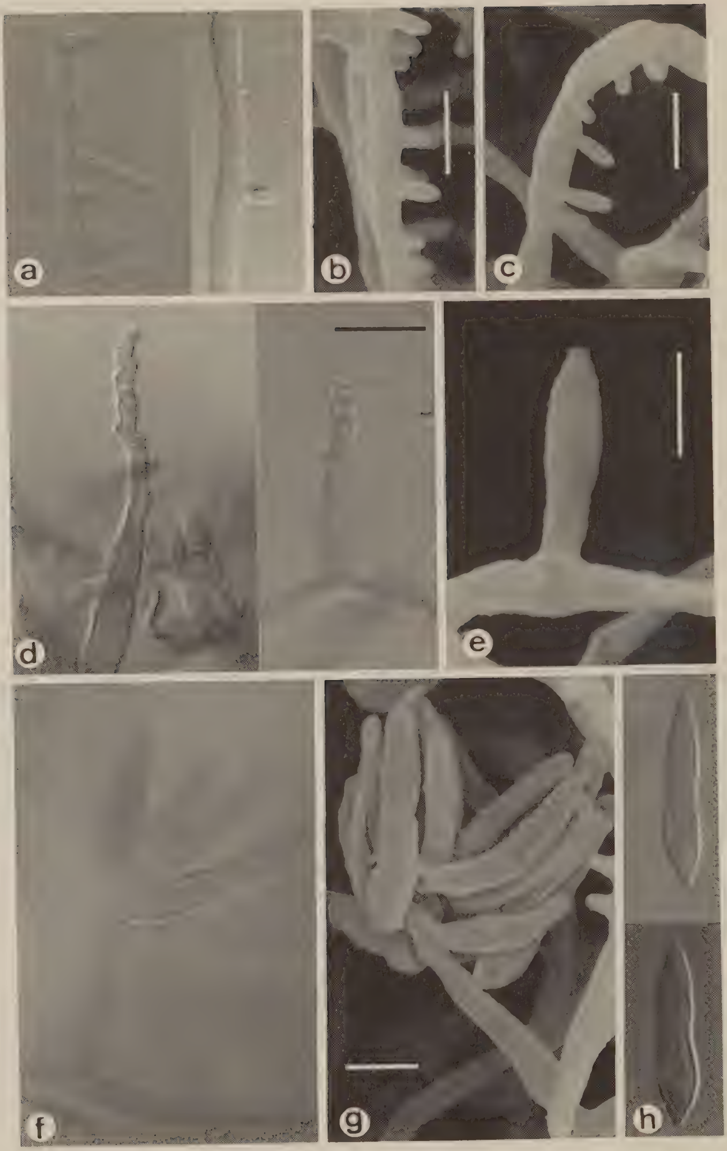


Fig. 1.- *Zeloasperisporium hyphopodioides* (C94/114). a-c, hyphopodia (a, on natural substrate; b,c, on SNA). d-g conidiophores, conidiogenous cells and conidia. Conidophore and conidia (f, on natural substrate; g, on SNA). h, conidia (a,d,f,h, bar = 10 µm; b,c,e,g, bar = 5 µm).

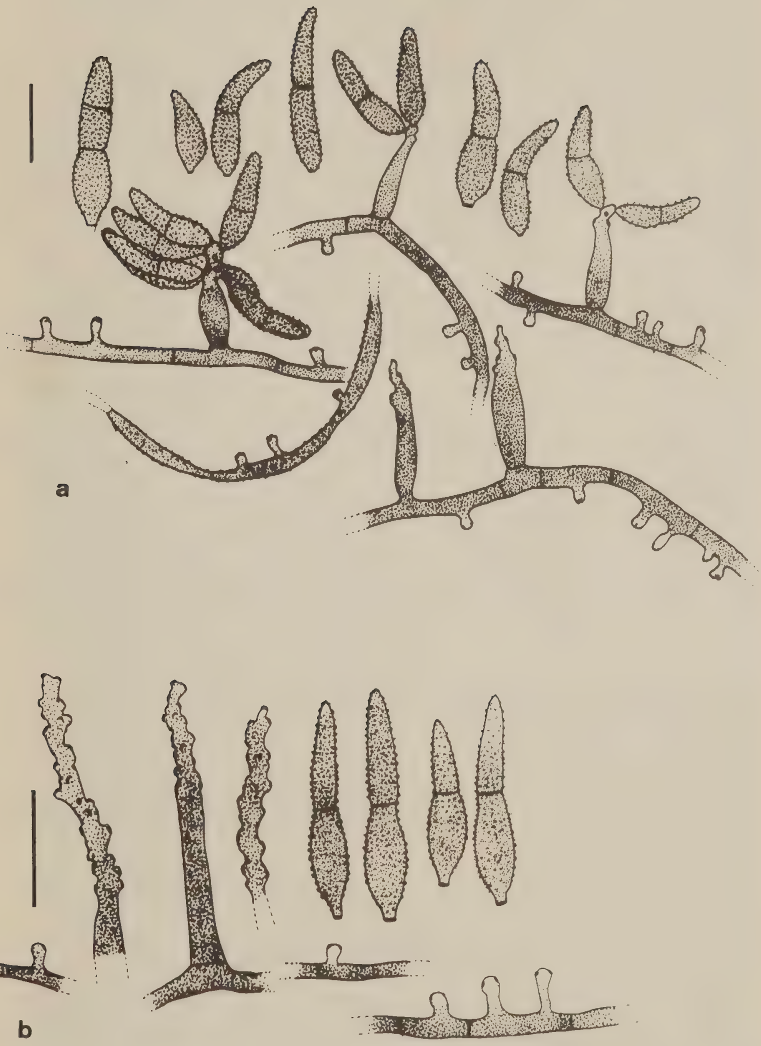


Fig. 2.- *Zeloasperisporium hyphopodioides* (C94/114). Conidiophores, conidiogenous cells and conidia (a, on SNA; b, on natural substrate) (bar = 10 µm)

OTHER AIRBORNE CONIDIAL FUNGI COLLECTED.

Arxiella terrestris Papendorf., **Trans. Br. Mycol. Soc**. 50: 73 (1967)
Specimen examined: INIFAT C93/112, from air, Playa. C. Havana, Cuba, 10. Aug. 1994, R.F. Castañeda.

Botryotrichum peruvianum Matsushima, **Icon. microf**. a **Matsushima lect**., Kobe: 17 (1975)
Specimen examined: INIFAT C93/233 from air, C. Havana, Cuba, 12, Feb. 1993, R.F. Castañeda.

Curvularia tuberculata Jain, **Trans. Br. Mycol. Soc.** 45: 539 (1962) Fig.3 a,b
Specimen examined: INIFAT C94/107 from air, C. Havana, Cuba, 4, Oct. 1994, R.F. Castañeda.

Curvularia verrucosa Sivanesan, **Mycol. Res.** 96: 485 (1992)
Specimen examined: INIFAT C93/234 from air, C. Havana, Cuba, 12, Feb. 1993, R.F. Castañeda.

Dactylaria kumamotoensis Matsushima, Matsush. Mycol. Mem. 2: 5 (1981).
Fig.3 c,d
Specimen examined: INIFAT C94/128, from air, C. Havana, Cuba, 4, Oct. 1994, R.F. Castañeda.

Dwalomyces taiwanensis Matsushima, Matsush. Mycol. Mem. 5: 14 (1987)
Specimen examined: INIFAT C93/57, from air, Playa, C. Havana, Cuba. 9, Feb. 1993. R.F. Castañeda.

Tritirachium oryzae (Vincens) de Hoog, Stud. Mycol. 1: 22 (1972)
Specimen examined: INIFAT C93/97, from air, Ciudad Habana, Cuba, 9, Feb. 1993. R.F. Castañeda.

ACKNOWLEDGEMENTS

We gratefully acknowledge Dr. E. Descals (Inst. Estudis Avançats de les Balears, C.S.I.C.) for serving as pre-submission reviewers, The Cuban Ministry of Agriculture for facilities during this work. This work was supported by the "Fundación Ciencia i Salut", Reus, Spain.

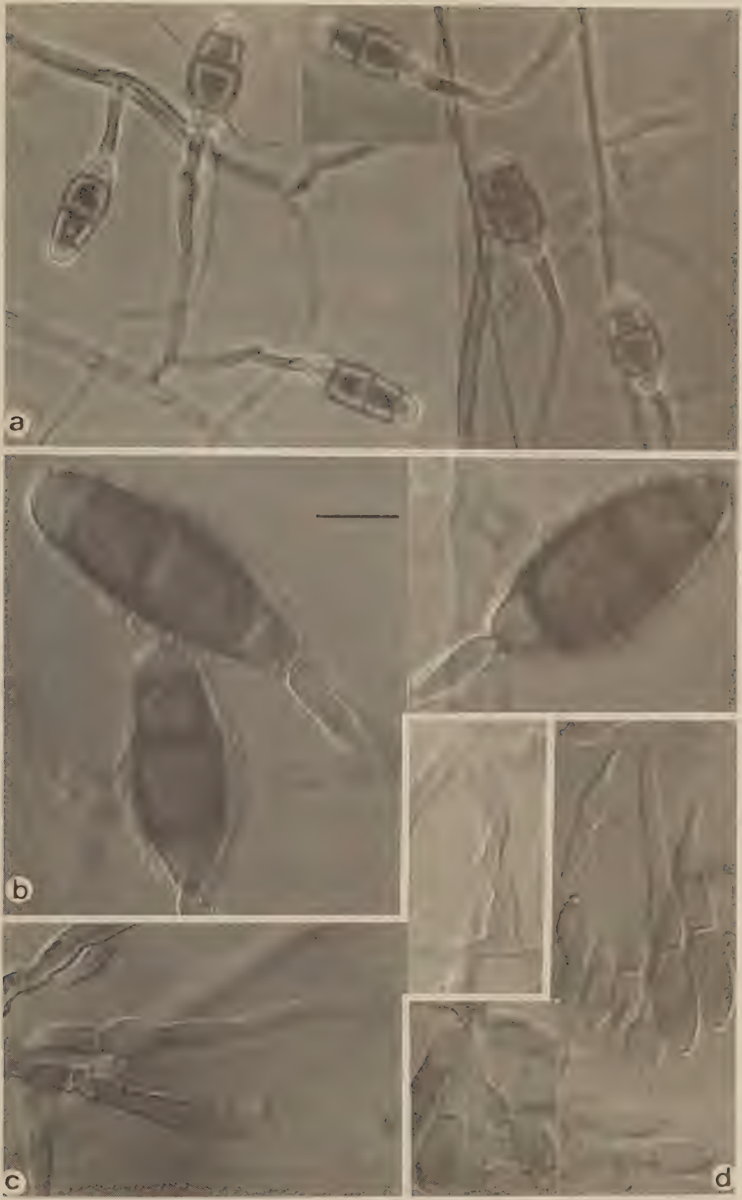


Fig 3 - *Curvularia tuberculata* (INIFAT C94/107) a,b (a, bar = 25 µm, b, bar = 10 µm)
Dactylaria kumamotoensis (INIFAT C94/128). c,d (bar = 10 µm)

REFERENCES

Arx, J.A.von (1983). *Mycosphaerella* and its anamorphs. **Proc. K. Ned. Akad. Wet.,c**, 86: 15-54.

Arx, J.A.von (1987). **Plant pathogenic fungi**. Beihefte zur Nova Hedwigia, 87: 1-188

Ellis, M.B. (1971). **Dematiaceous hyphomycetes**. Commth. Mycol. Inst. Kew. 608 pp.

Ellis, M.B. (1976). **More Dematiaceous hyphomycetes**. Commth. Mycol. Inst. Kew. 507 pp.

Nag Raj,T.R.(1993). **Coelomycetous anamorphs with appendage-bearing conidia**. Mycologue Publications, Waterloo, 1101 pp.

Nirenberg,H.I.(1976).Untersuchungen über die morphologische und biologische Differenzierung in der *Fusarium*-Sektion Liseola. **Mitteil. Biol. Bundesanst. Land-Forstw**; Berlin-Dahlem 169,117 pp.

MYCOTAXON

Volume LX, pp. 291-303 October-December 1996

EGYPTIAN UREDINALES. I. RUSTS ON WILD PLANTS FROM THE NILE DELTA.

ZAKARIA A. BAKA[1] AND HALVOR B. GJÆRUM[2]

1. *Department of Botany, Faculty of Science, University of Mansoura, Egypt.*
2. *Planteforsk, Plant Protection Centre, Fellesbygget, N-1432 ÅS, Norway.*

ABSTRACT

Twenty-three rust species on moncotyledonous and dicotyledonous wild plants were recorded in the Nile Delta, Egypt, from the period of **1991-1994.** One *Melampsora* species, eighteen *Puccinia* species, and four *Uromyces* species were identified. Eight *Puccinia* species are recorded as new to Egypt, viz. *Puccinia striiformis* on *Lolium perenne*, *P. polypogonis* on *Polypogon monspeliensis*, *P. fragosoana* and *P. imperatae* on *Imperata cylindrica*, *P. cynodontis* on *Cynodon dactylon*, *P. cyperi-tegetiformis* on *Cyperus rotundus*, *P. isiacae* on *Phragmites australis* and *P. lagenophorae* on *Senecio glaucus* and *S. aegyptius*.

El-Helaly *et al.* (**1966**) published the only report about the names of some rust species and their hosts in Egypt up to 1965 without detailed descriptions of the fungi.

Melampsora euphorbiae (Schub.) Cast., Obs. Pl. Acotyl. 2:18 (**1843**).
Syn. *M. helioscopiae* Wint. in Rabh. Krypt.-Fl., 2, I, 1:240 (**1882**); *M. euphorbiae-gerardiana* W. Muller.
On *Euphorbia peplus* L., *E. helioscopia* L., *E. heterophylla* L. (Euphorbiaceae), II+III.
Localities: Univ. Mansoura farm, Mansoura-Zagazig Rd.
Uredinia amphigenous, hypophyllous with capitate, thick-walled, hyaline paraphyses. Urediniospores globoid or ellipsoid, 18-22 x 12-20 µm, with paraphyses intermixed, wall colorless, 2-3 µm thick, finely echinulate, pores invisible. Telia amphigenous and occasionally caulicolous, dark brown, subepidermal., Teliospores prismatic, 30-44 x 7-13 µm, wall yellowish brown 1-1.5 µm thick.

Many *Melampsora* species have been described on *Euphorbia* spp., but according to Jørstad (**1958**) "it seems impossible to draw definite lines of demarcation between the various species". *M. euphorbiae* s. lat. is widespread nearly all over the world. The first record of this rust in Egypt was given by v. Thümen (**1979**) and Roumeguere (**1881**) on *Euphorbia* sp. Later it has been reported on *E. arguta* Soland., *E. cornuta* Pers., *E. peploides* Gaven and *E. peplus* L. (cfr. El-Helaly *et al.* **1966**). *E. helioscopia* and *E. heterophylla* are new hosts for the rust in Egypt, but they have been reported as such from other countries, including Africa. Castellani & Ciferri (**1937**) reported it on *E. monticola* Hochst. in Eritrea and later Castellani & Ciferri (**1950**) on *E. schimperiana* Scheele from Sidamo. Bisby & Wiehe (**1953**) and Gjærum (**1977**) have reported it on *E. depauperata* A. Rich. in Ethiopia and Malawi, respectively. Stewart & Yirgou (**1967**) and Gjærum (**1985**) have reported it on *E. heterophylla* from Zimbabwi and Uganda, respectively.

Puccinia cancellata Sacc. & Roum., Rev. Myc. 9:26 (**1881**).
Syn. *Uredo cancellata* Dur. & Mont., Fl. Alger. 1:314 (**1846**).
On *Juncus acutus* L. (Juncaceae), II+III.
Localities: Baltim, Rashid, Mansoura-El-Mahala Rd.
Uredinia large, elongate, surrounding the stem, dehiscing with a longitudinal slit, chestnut-brown. Urediniospores ellipsoid, pale brown, 32-39 x 19-26 µm, wall 2.5-4 µm, echinulate, 3 equatorial germ pores. Telia mixed with uredinia. Teliospores oblong, pale brown, constricted at septum, 34-47 x 20-27 µm; wall 3-4 µm thick at sides, 6-7 µm at apex, smooth; pedicels hyaline, slender, deciduous, up to 45 µm.

J. acutus is the main host for this rust, known from many countries around the Mediterranean Sea, going east to Iran. It is also reported from the Canary Islands, Madeira, Azores and Great Britain. Reichert (**1921**) reported *P. rimosa* Wint. (= *P. cyrnaea* Maire) on *J. acutus, J. maritimus* Lam. and *J. subulatus* Forsk. (cfr. Melchers **1931** and El-Helaly *et al.* **1966**). As *J. maritimus* is the main host of *P. cyrnaea* this record might be doubtful.

Puccinia carthami Corda, Ic. Fung. 4:15 (**1840**).
Syn. *Bullaria carthami* (Corda) Arth. & Mains, N. Am. Fl. 7:512 (**1922**).
On *Carthamus tinctorius* L. (Asteraceae), II.
Localities: Kalabshu, Baltim.
Uredinia amphigenous, scattered, brown. Urediniospores globose, 22-26 x 20-24 µm; wall chestnut-brown, 1.5-2 µm thick, echinulate, 2-3 equatorial germ pores.

C. tinctorius is the main host for this rust in N. America, Europe, Australia and Africa. It is also reported on other *Carthamus* spp., especially in Asia, but also in Portugal, Spain and Morocco. In infection experiments Parmelee (**1960**) got very week infections on *Centaurea cyanus* L. From Egypt it was first reported by Reichert (**1921**) and Snell (**1923**). Reichert´s record is also mentioned by Melchers (**1931**) and El-Helaly *et al.* (**1966**).

Cummins (**1977**) made this rust species synonymous with *P. calcitrapae* DC. var. *centaureae* (DC.) Cumm.

Puccinia cenchri Diet. & Holw. var. ***africana*** Cumm., Torrey Bot. Club Bull. 79:217 (**1952**).
Syn. *Uredo cenchricola* P. Henn., Mus. Congo Anal. 2:223 (1908).
On *Cenchrus biflorus* Roxb. (Poaceae), II.
Localities: Damietta-Port Said Rd., Univ. Mansoura farm, Ismailia.
Uredinia amphigenous, cinnamon-brown. Urediniospores ellipsoid, 29-38 x 22-30 µm; wall cinnamon-brown, echinulate, 2-3 µm thick, 4-5 equatorial germ pores.

P. cenchri var. *africana* is reported from many African countries, often as *Uredo cenchricola* P. Henn. It is new to the rust flora of Egypt.

Puccinia cynodontis Lacroix ex Desm., Pl. Crypt. Ser. III, No. 655. (1859).
Syn. *Uredo eleusine-indicae* Saw., J. Taihoku Soc. Agr. For. 7:41 (1943).
On *Cynodon dactylon* (Pers.) L. (Poaceae), II + III.
Localities: Ismailia, Tanta, Baltim.

Uredinia on abaxial surface, cinnamon-brown. Urediniospores globoid, 21-27 x 20-23 μm, wall 2-3 μm thick, light brown, verrucose, 2-3 equatorial germ pores. Telia amphigenous, hypophyllous, dark brown, elongated. Teliospores ellipsoid, with papillate tip, 29-52 x17-21 μm, the wall is 1.8-2.4 μm thick at the sides, 4.5-11 μm at apex, pedicels light brown, thin-walled.

P. cynodontis, a heterocious rust species with aecia (*Aecidium plantaginis* Ces.) on hosts belonging to many plant families, is circumglobal in temperate and warmer areas. It is widespread, especially in Africa, but this the first record of it in Egypt. The aecial stage has been found on *Adonis* sp. in Tunisia and on *Plantago coronopus* L. in Algeria.

Puccinia cyperi-tegetiformis Kern, Mycologia 11:134 (**1919**).
Syn. *Uredo cyperi-tegetiformis* P.Henn., Bot. Jahrb. 34:593 (**1905**).
On *Cyperus rotundus* L. (Cyperaceae), II.
Locality: Univ. Mansoura farm.
Uredinia mostly on abaxial surface, elongated, cinnamon-brown. Urediniospores pale brown, 20-26 x 16-19 μm., wall dark brown, echinulate, 1.5-3.5 μm thick, 2 equatorial germ pores.

This rust species is reported on many *Cyperus* spp. scattered all over Africa, and it is also known in Japan (type locality) and in the Americas. The rust is new to the flora of Egypt, but *C. rotundus* has previously been reported as a host in Uganda and Chad (Gjærum **1990**).

Puccinia fragosoana Beltrán, Mem. Roy. Soc. Espan. Hist. Nat. 50:249 (**1921**).
Syn. *Uredo schizachyrii* Doidge, Bothalia 2:508 (**1928**).
On *Imperata cylindrica* (L.) Raeuschel. (Poaceae), II.
Localities: Ras El-Bar, Kafr Saad, Kafr El-Batikh, Port Said.
Uredinia amphigenous, dark brown, capitate colorless paraphyses with thin wall and 8-15 μm thick at the head. Urediniospores golden to brown, obovoid, 31-44 x 20-28 μm, wall 1.5-2.5 μm thick, 3.5-7.5 μm at apex, echinulate, 4-5 equatorial germ pores.

P. fragosoana, widespread in Africa, and also reported from Palestine, is new to the rust flora of Egypt. It is easily separated from *P. imperatae* Poirault by the presence of uredinial paraphyses. Other paraphysate rust species on the same host in Africa differs from *P. fragosoana* having urediniospores not thickened apically.

Puccinia graminis Pers., Syn. Meth. Fung. p. 228 (**1801**) spp. ***graminis***
Syn. *P. albigensis* Mayor, Rev. Mycol. 22: 279 (**1957**).
On *Cynodon dactylon* (L.) Pers. (Poaceae), II.
Localities: Kafr Saad, Ras El-Bar, Kafr El-Batikh-Damietta road.
Uredinia amphigenous, cinnamon-brown. Urediniospores orange 23-39 x 15-24 µm, ellipsoid, the wall is 1.5-2 µm thick, echinulate, 3-5 equatorial germ pores.

P. graminis ssp. *graminis*, the black stem rust, is circumglobal, occurring on many genera of Poaceae. In Egypt it has been reported on *Avena sativa* L., *Hordeum vulgare* Lam. and *Triticum* spp. (Melchers **1931**). *C. dactylon* is a new host for this rust in Egypt. The aecial stage on *Berberis* spp. (*Aecidium berberidis* Pers.) has been reported from Morocco and Algeria.

The other subspecies, ssp. *graminicola* Urban, differs from the ssp. *graminis* having shorter urediniospores.

Puccinia imperatae Poirault, Assoc. Nat. Nice Bull. 1:105 (1913).
Syn. *Uredo imperatae* Magn., Zool.-Bot. Ges. Wien Verhandl. 50:439 (1900),
On *Imperata cylindrica* (L.) Raeuschel. (Poaceae), II.
Localities: Ras El-Bar, Kafr El-Batikh, Port Said.
Uredinia amphigenous, light yellow. Urediniospores hyaline, globoid, 22-30 x 20-26 µm, wall yellowish, 1-2 µm thick, 3.5-7 µm at apex, echinulate, 4 equatorial germ pores.

P. imperatae is a Mediterranean rust species, described from France, but it is also reported from S. Africa. It is new to the rust flora of Egypt.

Puccinia isiacae Wint. in O. Kuntze Plantae orient.-ross. p. 127 (1887).
On *Phragmites australis* (Cav.) Trin. (Poaceae), II+III.
Localities: Kafr El-Batikh-New Damietta Rd., Kafr Saad El-Balad.
Uredinia amphigenous, scattered on leaves in large groups. Urediniospores ellipsoid, 21-32 x 19-22 µm; wall cinnamon-brown, echinulate, 3-4 µm thick, 3 equatorial pores. Telia amphigenous, chocolate-brown. Teliospores brown, 35-54 x 20-30 µm; wall 3-4 µm thick at sides, 5-7 µm at apex; pedicels thick-walled up to 170 µm long.

P. isiacae was first reported from Egypt by v. Thümen (**1879**) on *Arundo isiacae* Del. (= *Phragmidium australis* (Cav.) Trin.). Later it has been listed by Reichert (**1921**), Melchers (**1931**) and El-Helaly *et al.* (**1966**). In Africa this rust is reported from Morocco and Tunisia. It is reported from many countries in S. Europe and Asia.

The aecial stage occurs on hosts belonging to about 20 plant families (Cummins **1971**), but this stage is not reported from Egypt.

Puccinia lagenophorae Cooke, Grevillea 13: 6 (**1884**).
Syn. *Puccinia terrieriana* E. Mayor, Ber. Schweiz. Bot. Ges. 72: 266 (**1962**).
On *Senecio glaucus* L. and *S. aegyptius* L. (Asteraceae), I+III.
Localities: Baltim, Rashid, Kafr Saad El-Balad, Ras-El-Bar.
Aecia amphigenous, on stems and leaves, orange. Aeciospores polygonal, 12 x 17 µm. Wall hyaline, finely verrucose, 0.8 µm thick. Telia pulvinate, dark, sparsed on the stems. Teliospores clavate to ellipsoid, 30-40 x 12-20 µm. Wall smooth, 1.5-2 µm thick at sides and 5.5-8.5 µm at apex; pedicels persistent, hyaline, 23-42 x 3.5-6 µm. Some telia have up to 16% 1-celled mesospores, 18-32 x 11-16 µm.

P. lagenophorae is described from Australia where it lives on many asteraceous genera. It seems rare in Africa, but since **1960** it has spread in South and Central Europe, and also in Norway, mainly on *Senecio vulgaris* L. It is also reported from Argentina. There is no previous report on this rust from Egypt. *S. aegyptius* is a new host for this rust while *S. glaucus* (as ssp. *coronopifolius* (Maire) Alexander) has been reported as a host from the Canary Islands (Gjærum **1987**).

Puccinia magnusiana Koern., Hedwigia 15:179 (**1876**).
Syn. *Puccinia alnetorum* Gaeum., Hedwigia 80:139 (**1941**).
On *Arundo donax* L. (Poaceae), II+III.
Localities: Kafr Saad El-Balad, Damietta-Ezbet El-Borg Rd.
Uredinia amphigenous, yellowish brown, with capitate, hyaline paraphyses, 35-60 μm long; wall 1.5-3.5 μm at sides, 4-6 μm at apex. Urediniospores ellipsoid or oval, 22-39 x 14-19 μm; wall yellowish brown, 1.5-2.5 μm thick, echinulate, 7-10 scattered germ pores. Telia amphigenous, dark brown. Teliospores oblong to ellipsoid, 37-57 x 15-28 μm; wall chestnut-brown, smooth, 1.5-3 μm thick at sides, 6-12 μm at apex; pedicels brownish, persistent, up to 60 μm long.

P. magnusiana is a circumglobal rust, living on *Arundo* and *Phragmites*. *A. donax* is a new host for this rust in Egypt, but it is previously reported on *Phragmites communis* Trin. var. *isiaca* (Del.) Cosson (= *P. australis* (Cav.) Trin.) (Reichert **1921**). It has been reported on *A. donax* in Europe and Asia.

Puccinia menthae Pers., Syn. Meth. Fung. p. 227 (**1801**)
On *Mentha longifolia* L. (Lamiaceae), II.
Localities: Rashid, Baltim, Kalabshu.
Uredinia mostly hypophyllous, irregularly scattered or occasionally in concentric groups. Urediniospores ellipsoid, 21-27 x 16-19 μm. The wall 1.5-2.5 μm thick, finely echinulate, 3 equatorial germ pores.

P. menthae is circumglobal, living on many lamiaceous host genera. In Africa it has been reported from many countries from the Mediterranean through East Africa to S. Africa (Gjærum **1977**). El-Helaly *et al.* (**1966**) reported it in Egypt on *Mentha* x *piperita* L. as did Melchers (**1931**). Also, Hennings (**1891,1893**) and Jørstad (**1956**) have reported it on *Mentha longifolia* from Eritrea. Gjærum (**1977**) have reported it on *Satureja paradoxa* (Vatke) Engl. from Ethiopia.

Puccinia polygoni-amphibii Pers., Syn. Meth. Fung. p. 227 (**1801**) var. ***polygoni-amphibii.***
Syn. *Aecidium sanguinolentum* Lindr., Bot. Notiser: 241 (**1900**).
On *Polygonum salicifolium* Brouss. ex Willd. (Polygonaceae), II.

Locality: Damietta-Kafr El-Batikh Rd.
Uredinia amphigenous, mostly hypophyllous, rounded, brownish. Urediniospores ellipsoid, 18-32 x 16-21 µm; wall cinnamon-brown, echinulate, 1-1.5 µm thick, 2-3 supra-equatorial germ pores.

This rust taxon is circumglobal, mainly on species of *Polygonum*, but it occurs also on the related genus *Oxygonum*.. In Africa it is reported scattered from Morocco, Algeria and Libya, but we have seen no record from Egypt. The aecial stage (*Aecidium sanguinolentum* Lindr.) has been reported by Maire (**1905**) on *Geranium atlanticum* Doiss from Algeria.

Puccinia polypogonis Speg., An. Mus. Nas. B. Aires 19:300 (**1909**).
Syn. *Uredo polypogonis* Speg., An. Mus. Nas. B. Aires 6:240 (**1899**).
On *Polypogon monspeliensis* (L.) Desf. (Poaceae),II.
Localities: Alexandria, Faraskur.
Uredinia on abaxial leaf surface, cinnamon-brown. Urediniospores obovoid, golden, 23-29 x 22-25 µm. The spore wall echinulate, 1.5-2 µm thick, 5-7 scattered germ pores with conspicuous caps.

P. polypogonis, described from Argentina, occurs on *Polypogon* ssp. in S. America and S. Africa. It is new to the rust flora of Egypt.

Puccinia recondita Roberge ex Desmazieres, Bull. Soc. Bot. France 4:798 (**1857**).
Syn. *Puccinia dasypyri* Guyot & Malen., Trav. Inst. Sci. Cherif Ser. Bot. 28:62 (**1963**).
On *Lolium perenne* L. (Poaceae), II.
Localities: Kafr Saad El-Balad, Ismailia.
Uredinia amphigenous, cinnamon-brown. Urediniospores broadly obovoid, 23-35 x 19-27 µm; wall 1-2 µm thick, yellowish brown, echinulate, 6-9 scattered germ pores.

P. recondita, a circumglobal rust species, most common in temperate areas, is treated here as an aggregate species, occurring on a large number of host genera of Poaceae. As *P. dispersa* Eriks. & P. Henn. it has been reported from Egypt on *L. temulentum* L. by Reichert (**1921**). *L. perenne* is a new host for this rust in Egypt.

Puccinia scirpi DC., Fl. Fr. 2:223 (1805).
On *Bolboschoenus maritimus* (L.) Palla (syn. *Scirpus maritimus* L.) (Cyperaceae), II.
Localities: Talkha-Belqas Rd., Damietta-Port Said Rd.
Uredinia scattered or in rows, oblong, brown. Uredinospores ovoid to sub-globoid, flattened on one side, 20-30 x 11-25 µm; wall pale brown, echinulate, 2-3 µm thick, 2 equatorial germ pores.

Reichert (**1921**) reported this rust on *Scirpus* sp. while Melchers (**1931**) and El-Helaly *et al.* (**1966**) reported it on the host mentioned above in Egypt. From Morocco and Tunisia it is reported on *Schoenoplectus lacustris* (L.) Palla (syn. *Scirpus lacustris* L.).

The aecial stage occur on species of *Limnanthemum* and *Nymphoides*, but to our knowledge it is not reported from Africa.

Puccinia striiformis Westend., Bull. Roy. Acad. Belg., Cl. Sci. 21:235 (**1854**) var. ***striiformis***.
Syn.*Uredo glumarum* J. K. Schmidt, Allgem. Oekon.-tech., Fl. 1:27 (**1827**).
Puccinia stapfiolae Mundk. & Thirum., Imp. Mycol. Inst. Kew Mycol. Papers 16:14 (**1946**).
On *Lolium perenne* L. (Poaceae), II+III.
Localities: Univ. Mansoura farm, Zagazig.
Uredinia amphigenous, in linear series in chlorotic streaks, orange, with saccate paraphyses, 12.5-24 µm diam., wall colorless, 0.5 µm thick. Uredinispores broadly ellipsoid, 22-31 x 17-25 µm; wall pale yellowish, 1.5-2 µm thick, echinulate, 9-13 scattered germ pores. Telia on abaxial leaf surface, with brown paraphyses. Teliospores oblong, 35-63 x 14-23 µm.; wall deep golden brown, smooth, 1.5-2 µm at sides and 5-9 µm apically; pedicels colorless to brownish, thin-walled, less than 18 µm long.

P. striiformis var. *striiformis*, the stripe rust, is circumglobal, especially in the northern hemisphere, where it lives on many species of

Poaceae. As *P. glumarum* it has been reported from Egypt on *Hordeum vulgare* L. and *Triticum* spp. (Melchers **1931**).

Another variety, var. *dactylidis* Manners on *Dactylis glomerata* L., has smaller spores. So far it is not reported from Africa.

Puccinia tuyutensis Speg., Fungi Argent. 4:25 (**1881**).
Syn. *P. cressae* Lag. in Bol. Soc. Brot., p.131 (**1889**); *Aecidium cressae* DC., Fl. Fr. 6:89 (**1815**).
On *Cressa cretica* L. (Convolvulaceae), I+II+III.
Localities: Baltim, Kalabshu.
Aecia hypophyllous on stems and leaves, orange. Aecidiospores globoid, hyaline, 20-26 x 19-25 µm, wall thin 1-2 µm, verrucose. Uredinia hypophyllous, cinnamon. Urediniospores ellipsoid, 23-30 x 23-25 µm, wall 2-3 µm thick, echinulate, 2-3 equatorial germ pores. Telia hypophyllous, dark brown, scattered. Teleutospores brown, 41-45 x 23-27 µm, wall 3-4 µm thick and 5.5-7.5 µm at apex, pedicels fragile, hyaline.

This rust is widespread in Asia and the Americas, and also in Mediterranean countries in Africa and as well as in Europe. Reichert (**1921**) and El-Helaly *et al.* (**1966**) reported it as *P. cressae* on the host mentioned above from many localities in Egypt.

Uromyces linearis Berk. & Br., J. Linn. Soc. London 14:92 (**1875**).
On *Panicum coloratum* L. (Poaceae), II+III.
Locality: Univ. Mansoura farm.
Uredinia epiphyllous, cinnamon-brown, oval to elongated. Urediniospres globose, dull golden, 23-29 x 21-25 µm, wall 2.3-3.7 µm thick, finely to compactly echinulate, 2-3 equatorial germ pores. Telia epiphyllous, dark brown, compact. Teleutospores, brown, broadly ellipsoid, 23-32 x 18-27 µm, wall 2.4-3.8 µm thick, 4.5-7.5 µm at apex, smooth, pedicels yellowish, 95 µm.

P. repens is the main host for this rust species, known from Africa and tropical and eastern Asia. It was reported from Egypt by Reichert (**1921**). Later the same specimen has been mentioned by Melchers (**1931**) and El-Helaly *et al.* (**1966**).

Uromyces rumicis (Schum.) Wint. Hedwigia 19:37 (**1880**).
On *Rumex dentatus* L. (Polygonaceae), II+III.
Localities: Univ. Mansoura farm, Gamasa, Kafr Saad El-Balad.
Uredinia amphigenous, scattered, minute, round, cinnamon. Urediniospores globoid to ellipsoid, pale brown, 21-29 x 19-25 µm.; wall brown, 1.5-2 µm thick, echinulate, 3 equatorial germ pores. Telia brown, round, scattered. Teliospores subgloboid to ovoid, brown, 25-34 x 19-27 µm; wall dark brown, 2-2.5 µm thick, smooth, with hemispherical papilla; pedicels thin, hyaline, deciduous.

U. rumicis was first collected in Egypt by v. Thümen (cf. Reichert **1921**), and later mentioned by Melchers (**1931**) and El-Helaly *et al.* (**1966**). It is common in Europe and Asia, rare in the Americas and Australia. In Africa it has been reported from the Mediterranean area to S. Africa.

Uromyces setariae-italicae Yosh., Bot. Mag. Tokyo 20:247 (**1906**).
On *Setaria verticillata* (L.) Beauv. and *S. glauca* (L.) Pal. (Poaceae), II+III.
Locality: Univ. Mansoura farm.
Uredinia amphigenous, cinnamon-brown, elongated, scattered. Urediniospores ellipsoid, 26.5-35 x 24-27.5 µm, wall 1.5-2 µm thick, reddish brown, echinulate, 3 equatorial germ pores. Telia amphigenous, dark brown. Teliospores globoid to obovoid, 18-24 x 16.5-19.5 µm, wall reddish brown, 1-1.5 µm thick, smooth, pedicels colorless, thin-walled, up to 20 µm long.

This rust, widespread on many genera of Poaceae in warmer areas, has previously been reported on *S. viridis* (L.) Beauv. in Egypt (Melchers **1931**). The two hosts mentioned above are new to this rust in Egypt, but they are reported as hosts from other African countries.

Uromyces trifolii-repentis Liro & Liro, Bidr. Känned. Finl. Nat. Folk 65: 94 (**1908**) var. ***trifolii-repentis.***

On *Trifolium resupinatum* L. (Fabaceae), II+III.
Localities: Kafr El-Batikh, Damietta-Ras El-Bar Rd.

Uredinia amphigenous, cinnamon-brown. Urediniospores globoid, 19-24 x 22-26 μm; wall light cinnamon-brown, 1.5-2 μm thick, echinulate, 2-5 scattered germ pores. Telia hypophyllous, chestnut-brown. Teliospores globoid, 12.5-21 x 21-30 μm; wall cinnamon-brown, 1.5-2 μm thick with hyaline papilla, smooth; pedicels colorless, short, fragile.

U. trifolii-repentis is a widespread rust species, reported from Egypt by El-Helaly *et al.* (**1966**) and Elarosi *et al.* (**1974**) on *T. alexandrinum* L. and *T. resupinatum,* respectively. In Africa it has been reported on *Trifolium* spp. from Morocco and Algeria, and also from S. Africa.

BIBLIOGRAPHY

BISBY, G.R. & P.O.WIEHE. 1953. The rusts of Nyasaland. *Mycol. Papers*, No. 54.

CASTELLANI, E. & R. CIFERRI. 1937. Prodromus Mycoflora Africa orientalis italicae. *Bibl. Agr. Colon. Firenze.*

CASTELLANI, E. & R. CIFERRI. 1950. Mycoflora Erythraea, Somalia et Æthiopica. Supplementum I. *Suppl. Atti Ist. Bot. Univ. Pavia, Ser. 5, vol. H.*

CUMMINS, G.B. 1971. *The rust fungi of cereals, grasses and bamboos.* Berlin-Heidelberg-New York.

CUMMINS, G.B. 1977. Nomenclatural changes and new species in the Uredinales. *Mycotaxon* **5**: 398-408.

ELAROSI, H., S.H. MICHAIL & M.A. EL-MELEIGI. 1974. Occurrence of rusts of Persian clover and *Malva* spp. in Egypt. *Alex. J. Agric. Res.* **22**: 437-441.

EL-HELALY, A.F., I.A. IBRAHIM, M.W. ASSAWAH, H.M. ELAROSI, M.K. ABO-EL-DAHAB, S.H. MICHAIL, M.A. ABD-EL-REHIM, E.H. WASFY & M.A. EL-GOORANI. 1966. General survey of plant diseases and pathogenic organisms in U.A.R. (Egypt) until 1965. *Alex. J. Agric. Res., Fac. Agric. Res. Bull.* No. 15.

FAHMY, T. 1927. Egypte: Liste complimentaire des maladies des plantes observees en 1924-25. *Moniteur Intern. Proket. d. Plantes* **1:** 75.

GJÆRUM, H.B. 1977. Additions to the rust flora of Ethiopia. *Boletin de la Sociedad Argentina de Botanica,* **18**: 8-16.

GJÆRUM, H.B. 1985. East African rusts (Uredinales), mainly from Uganda 4. On families belonging to Apetalae and Polypetalae. *Mycotaxon* **24**: 237-273.

GJÆRUM, H.B. 1987. Rust fungi in the Canary Islands. *Vieraea* **17**: 51-71.

GJÆRUM, H.B. 1990. African host species of *Puccinia cyperi-tegetiformis* (Uredinales). *Lidia* **3**: 3-12.

HENNINGS, P. 1891. Fungi africani. *Engl. Bot. Jahrb.* **14**: 339-373.

HENNINGS, P. (1893). Fungi aethiopico-arabici. *Bull. Herb. Boissier* **1**: 26.

JØRSTAD, I. 1956. Reliquiae Lagerheimianae. African Uredinales. *Arkiv Bot.* **3**: 563-598.

JØRSTAD, I. 1958. Uredinales of the Canary Islands. *Skr. Utg. Set Norske Vidensk-Akad. Oslo. 1. Mat.-Nat.* No. 2.

MAIRE, R. 1905. Notes sur quelques champignons nouveaux ou peu connus. *Bull. soc. Mycol. France* **21**: 3-12.

MELCHERS, L.E. 1931. A check list of plant diseases and fungi occurring in Egypt. *Trans. Kansas Acad. Sci.* **34**: 41-106.

PARMELEE, J.A. 1960. The fungi of Ontario. I. Uredinales. *Canad. Dept. Agric., Publ. 1080.*

REICHERT, I. 1921. Die Pilzflora Ãgyptens. *Engler´s Jahrb.* **56**: 595-727, Taf. II-IV.

ROUMEGUERE, C. 1881. Champignons rapportés en 1880 d´un excursion botanique en Egypte et en Palestine par M. William Barley. *Rev. Mycologique* **3**: 23-25.

SNELL, K. 1923. Beiträge zur Kenntnis der pilzparazitären Krankheiten von Kulturpflanzen in Aegypten und ihre Bekampfung. *Angew. Bot.* **3**: 121-132. (Ref. R.A.M. 3: 323-324).

STEWART, R.B. & D. YIRGOU. 1967. Index of plant diseases in Ethiopia. Haile Selassie I Univ., *Coll. Agric., Exp. Sta. Bull.* **30**.

THÜMEN, F.V. 1879. Fungi Egyptiaci. Collecti per Dr. Georg Schweinfurth. *Grevillea* **8**: 49-51.

MYCOTAXON

Volume LX, pp. 305-315 October-December 1996

THE GENUS *PYROFOMES* IN ARGENTINA AND THE *CULTURAL FEATURES OF P. LATERITIUS* *(APHYLLOPHORALES)*

Jorge E. Wright, Marcela F. Bolontrade
and Alejandra T. Fazio

Departamento de Ciencias Biológicas, Facultad de Ciencias Exactas y
Naturales, Universidad de Buenos Aires.
1428. Buenos Aires. Argentina

Summary

A study of the two species of the genus *Pyrofomes* so far found in Argentina viz., *P. lateritius* and *P. perlevis* was undertaken, and the cultural features of *P. lateritius* are added. These finds are new records for this country and broaden the known distribution of the species of the genus in South America.

Introduction

The genus *Pyrofomes* was created by Kotlaba & Pouzar (1964) based on *Polyporus demidoffii* Lév. (Ryvarden, 1991). It is characterized by a rather massive applanate to hoof-shaped, perennial fruit-body, yellowish-orange to rusty-orange, dimitic-trimitic context, with clamped, hyaline, thin-walled generative hyphae and thick-walled, strongly rusty yellow, cyanophilous skeletals, occasionally with binding-like hyaline hyphae; thick-walled, truncate, variably dextrinoid, cyanophilous basidiospores, and absence of cystidia or other sterile hymenial elements.

Ryvarden (1972) added another species, *P. lateritius* (Cke.) Ryv., based on *Fomes lateritius* Cooke, described from Rio de Janeiro, Brazil (Saccardo, 1888).

The genus is probably related to *Perenniporia* and to *Loweporus* through its truncate spores, but the former has a white context, whereas the latter has a dark context and both have dextrinoid skeletal hyphae.

Pyrofomes demidoffii (Lév.) Kotl. & Pouzar (1964), has been recorded from Jugoslavia, Russia, Pakistan, U.S., Kenya, Ethiopia, Tanzania and Uganda. *P. lateritius* (Cooke) Ryv., originally cited from Rio de Janeiro, Brazil, was transferred to *Pyrofomes* by Ryvarden (1972). *P.perlevis* (Lloyd) Ryv. (Lloyd, 1912; 1915; Ryvarden 1972, 1989) recorded from Brazil, Colombia, Madagascar and Uganda, is close to *P. lateritius*. *P. albomarginatus* (Lév.) Ryvarden (1972), has been cited from Nigeria, Angola, Zaire, Pakistan, India, Sri Lanka, Thailand, Malaysia, Indonesia, Sarawak, the Philippines, and Australia. *P. aurantiacus* David & Rajchenberg, was described from French Guiana, and *P. tricolor* (W.A. Murrill) E.J.H. Corner, was recorded from W. Malaysia, India and Singapore (Corner, 1989).

Pyrofomes demidoffii (Lév.) Kotl. & Pouzar has been described in detail by Bondartsev (1971), as *Phellinus demidoffii* (Lév.) Bond. & Sing. and by Gilbertson and Ryvarden (1987). It appears to be fairly common on living *Juniperus* in western U.S., where it has been known as *Fomes juniperinus* (von Schrenk) Sacc. & Syd., causing a white trunk rot. It is also known from East Europe (Macedonia, Crimea, Caucasus) (Pilát, 1936) and the former Asiatic USSR (Uzbekistan, Siberia) on living *Juniperus excelsa* and also on pines and cypress (Bondartsev, 1971). Pilát (1936) states it is a subtropical species, seeking drier climate regions. The cultural features of *P. demidoffii* have been recorded by Campbell (1938), Nobles (1958, 1965) and Stalpers (1978).

Pyrofomes aurantiacus was placed in the genus by David & Rajchenberg (1985) because of the colour of the fruitbody, and purported to be close to *Fomes fulvo-umbrinus* Bres. from Brazil, which was placed by the same authors in the genus *Pyrofomes* (David & Rajchenberg, op. cit.). According to David and Rajchenberg (1985), the latter species is identical with *Perenniporia gomezii* Rajchenb. & Wright, described from N.W. Argentina (Rajchenberg & Wright, 1982), which Ryvarden (1988) accepted in *Pyrofomes*.

Pyrofomes tricolor, found in the Philippines, Malay Peninsula and India, has a trimitic hyphal system, and is composed of four varieties that differ in the form of the pileus, the pore surface and the spore size: *P. tricolor* var. *tricolor*, *P. tricolor* var. *eumorphus*, *P. tricolor* var. *shoreicola*, and *P. tricolor* var. *indicus*. It causes a white rot of dipterocarp trees (Corner, 1989) and is related to *P. perlevis* (Lloyd) Ryv., which has a trimitic hyphal system, and grows on deciduous trees.

Pyrofomes albomarginata (Lév.) Ryv., which is closely related to *P. tricolor*, has a paleotropical distribution (Ryvarden and Johansen, 1980). Thus, the specimen of *P. lateritius* would be the first record for Argentina, and since we were able to culture it, we herein describe the basidiocarps of *P. lateritius* and *P. perlevis* and the culture of the former species.

Materials and Methods

Hand sections of the basidiocarp were made with a razor blade and mounted in Melzer's reactive, a drop of an aqueous solution of phloxine mixed with a drop of 5% KOH, and lactophenol-cotton blue.

Replicates of stock cultures of *P. lateritius* on Difco malt-extract and Difco Bacto-agar were inoculated in Petri dishes on the same medium, incubated at 25 °C for six weeks and studied every week according to the protocol of Nobles (1958).

For oxidase reactions, Petri dishes containing gallic or tannic acid-Difco malt extract agar were inoculated according to the same procedure (Nobles, op.cit.).

Other enzymatic tests were carried out with tyrosine, paracresol and guaiacol (Boidin, 1954).

Colors are according to Munsell (1954).

Taxonomy

***Pyrofomes lateritius* (Cooke) Ryv., Mycotaxon 31: 45-58, 1988.**
= *Fomes lateritius* Cooke, Grevillea 9:12, 1880.

(Figs. 1-3)

Basidiocarp perennial, sessile, demediate-applanate, 20 x 15 x

5 cm; pileus surface covered by moss, radially sulcate towards the margin, dark reddish brown(3/3 5YR), semibrilliant, turning more yellowish towards the margin. Context zonate, dark reddish (3/6 2.5YR) to reddish (4/8 2.5YR) or lateritic, below which is a radially extended granular zone, parallel to the context and permeating the upper portion of the tubes, intercalating among them as thin whitish threads, formed by thin-walled, easily staining hyphae with granular contents, 3-8 μm diam.(Fig. 1 A). Pileus with no xanthochroic reaction

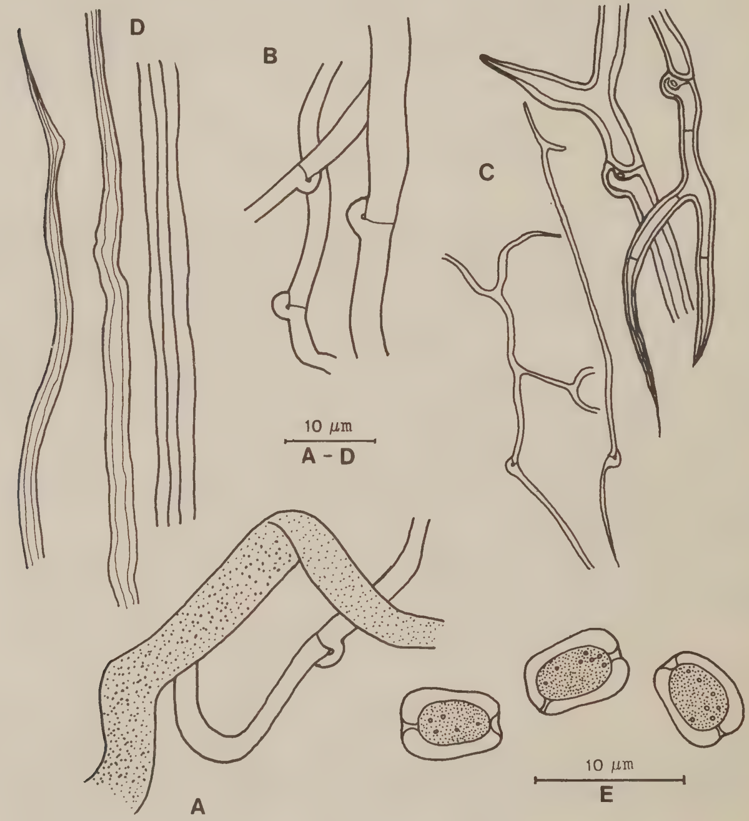


Fig. 1. *Pyrofomes lateritius*; A. hyphae of granular zone; B. thin-walled generative hyphae; C. thick-walled generative hyphae; D. skeletal hyphae; E. basidiospores

with 5 %. KOH. Context dark at first with 5 % KOH, but later turning cherry-red. Tubes ferrugineous, indistinctly stratified; tube length 1-2 mm ;pore surface reddish brown (4/4 5YR), covered by a greyish film; pores 4-5 per mm, 166-225 µm diam.; dissepiments 64-91 µm diam.

Hyphal system dimitic, composed of two types of generative hyphae: i) hyaline, thin-walled, clamped, easily stained, 2-6 µm diam.(Fig. 1 B) and ii) thick-walled, yellowish, branched, sparsely clamped, 0.8-4 µm diam. with very thin ends (Fig. 1 D). Basidia not observed. Basidiospores numerous, with the aspect of chlamydospores, hyaline to yellowish brown, very thick walled, truncate, variously shaped but mostly ellipsoid-truncate resembling corn grains, 5.2-6.7 x 4-5.4 µm, IKI-, slightly cyanophilous (Fig. 1 E).

Culture Description

Macroscopic characters: growth slow, covering 1 cm in one week and 6.5 cm at the end of six weeks; mycelial mat woolly-felty, margin silky, evident only at the 6th week; pale yellow (8/4 5Y) to yellow (8/6 5Y), with yellow patches (8/6 5Y) during the first three weeks, later exhibiting a white (8/1 5Y) margin which turns pale yellow (8/3 5Y) to yellow (7/6 10YR) towards the inoculum, and pale

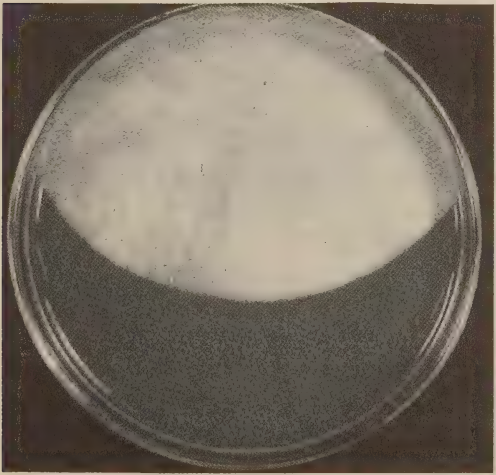


Fig. 2. Culture of *Pyrofomes lateritius*. Aspect of mycelial mat.

yellow (8/3 5Y) to white (8/1 5Y) on the inoculum; reverse unchanged (Fig. 2). Odorless.

Microscopic characters: Advancing zone: with numerous clamped generative hyphae, 2.6-4.2 µm diam. (Fig. 3 A); after the 2nd week thick- walled generative hyphae appear, 2.1-5.7 µm diam., and skeletals, 2.1-5.7 µm diam.,stained yellow after the 4th week (Fig. 3 B). Region of inoculum with numerous thin-walled generative hyphae 1.1-2.1 µm diam.; thick-walled generatives 2.1-2.6 µm diam. and skeletals 1.1-3.2 µm diam. after the 4th week; fibrous hyphae

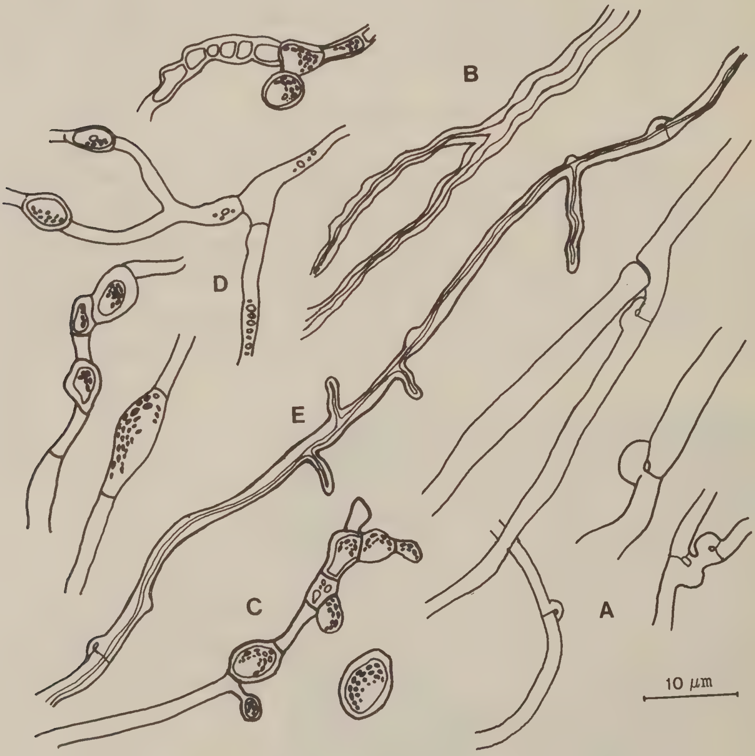


Fig. 3. Microscopic cultural features of ***Pyrofomes lateritius***; **A**. thin-walled generative hyphae; **B**. skeletal hyphae; C. chlamydospores; **D**. chlamydospores and generative hyphae with drops; **E**. uneven thick-walled generatives.

2-5 µm diam. Chlamydospores 4.6-6.3 x 5.2-15.6 µm, present in the advancing zone and in the inoculum (Fig. 3 C). After the 4th week, drops appear in the generative hyphae and chlamydospores, with a positive reaction in Sudan III, both in the advancing zone and in the inoculum (Fig. 3 D), and irregularly distributed uneven thick-walled generatives, 2.1-2.6 µm diam., with right-angled branches (Fig. 3 E).

Oxidase reaction: tannic acid= +++ with mycelial growth, colony 2.5 cm diam., halo 4 cm; gallic acid= +++ with variable growth, in some cases only on the inoculum, halo 4 cm diam.; p-cresol= –, without growth; tyrosine= –, with growth (colony 1 cm diam.); 0.2 % guaiacol= +++, with slight mycelial growth on the inoculum, halo 1.6 cm diam., 2 % guaiacol= –, without growth.

Species code: 2. 3. 8. (9). 24. 25. 34. 37. 38. 47. 53. 54.

Material studied: Argentina, Misiones, Iguazú National Park , in "Palo Rosa" (*Aspidosperma polyneuron*) forest, on living trunk of "incienso" (*Myrocarpus frondosus*) associated with a white rot.; leg. J.E. Wright; 8-IX-1992 (BAFC 33072; cult. n° 2153).

Remarks: Our material matches well the original description, except that the pores are smaller (7-9 per mm in the holotype according to Ryvarden, 1988). We did not observe basidiospores on the basidia.

The present collection expands the distribution area of this species further South in South America, since it has only been recorded from Rio de Janeiro and Amazonas, in Brazil.

Pyrofomes perlevis **(Lloyd) Ryv., Norw. J. Bot. 19: 236, 1972.**
= ***Fomes perlevis*** **Lloyd, Myc. Writ. 4 Letter No 39:2, 1912.**

(Figs. 4, 5)

Basidiocarp perennial, solitary, demediate to triquetous, 7 x 3.5 x 4 cm. Pileus glabrous brown (2/2 5YR), greyish brown (1/4 5YR) in the older parts, with no xanthochroic reaction. Margin velutinate, orange to orange-brown (4/8 5YR), 2-2.5 mm wide. Context ferrugineous-brown (4/6 2.5YR), 3.5 cm thick, later turning cherry-red with KOH, interrupted by tubes parallel to the context, intercalary with a granular zone composed of thin-walled hyphae with granular

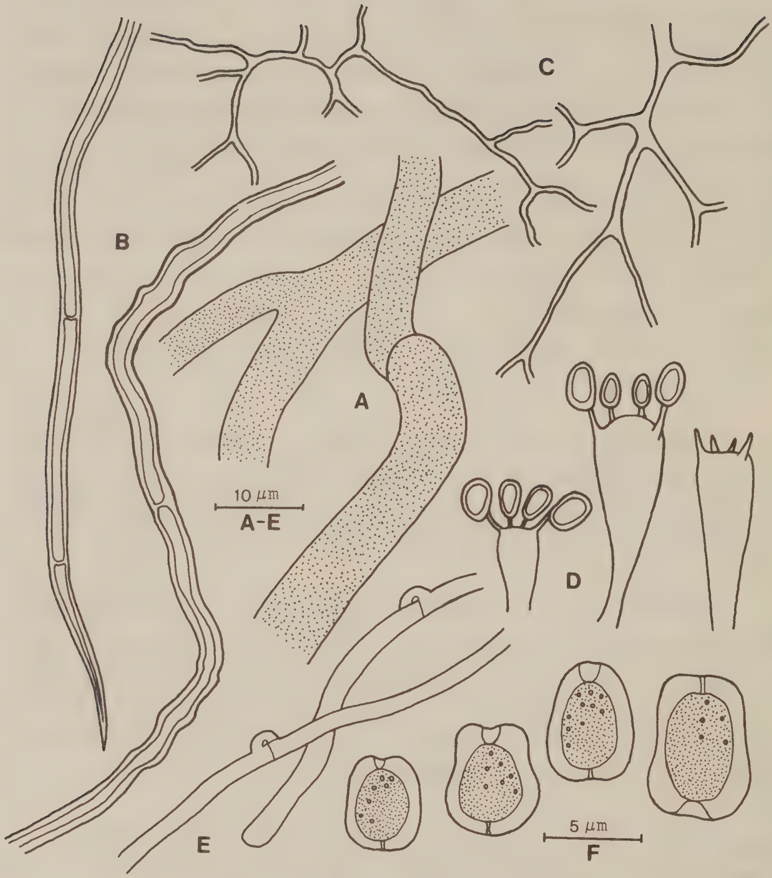


Fig. 4. ***Pyrofomes perlevis***; **A.** hyphae of granular zone; **B.** skeletal hyphae with secondary septa; **C.** binding hyphae; **D.** basidia; **E.** generative clamped hyphae; **F.** basidiospores.

contents, 2.2-7.8 μm diam. (Fig 4 A). Tubes concolorous with the pore surface, 3-4 mm long, variously stratified. Pore surface whitish with orange dissepiments, 113-231 μm diam.; pores 2-3 per mm, 349-392 μm diam.

Hyphal system trimitic (Fig. 5) with scant generative clamped

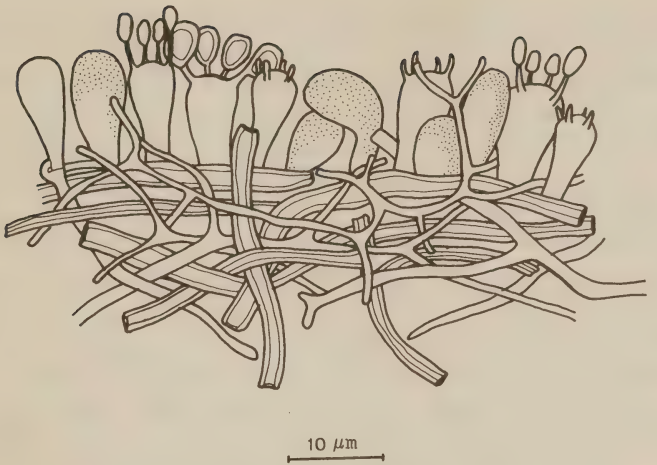


Fig. 5. *Pyrofomes perlevis*. Hymenial elements

hyphae, 2.1-2.6 µm diam. (Fig. 4 E); skeletal hyphae numerous, brown, with secondary septa and thin ends, thick-walled, 2.6-3.1 µm diam. (Fig. 4 B); hyaline, thick-walled hyphae, with almost solid lumen, branched, are interpreted as binding hyphae, 0.5-2.1 µm diam. (Fig. 4 C). Basidia clavate, 4-spored, 11.4-26 x 5.7-7.8 µm (Fig. 4 D). Cystidia absent. Basidiospores ellipsoid-truncate, resembling corn grains, thick-walled, dark brown, 5.2-7.8 x 3.6-5.7 µm, IKI-, not cyanophilous (Fig. 4 F).

Material studied: Argentina, Formosa, Ingeniero Suárez, on *Prosopis sp*. ("espinillo" and "algarrobo"); leg. Norma Guardia; 10-X-1986 (BAFC 33634).

Remarks: Both species are very close if not identical. However, they may be distinguished by pore size, viz. 166-225 µm, 4-5 pores per mm in *Pyrofomes lateritius*, and 349-392 µm, 2-3 pores per mm in *P. perlevis*, and by the dissepiments, 64-91 µm in *P. lateritius* and 113-231 µm in *P. perlevis.*

The fact that our study is based on very scanty material does not warrant conclusions concerning this problem.

On the other hand, a study of the holotypes of both *Fomes fulvo-umbrinus* and *Perenniporia gomezii* has confirmed that these epithets apply to the same taxon. However, we are reluctant to accept their inclusion in the genus *Pyrofomes* and rather believe they properly belong in *Perenniporia* as already suggested by Corner (1989).

The genus *Pyrofomes* was described as having sessile-not resupinate-perennial fruitbodies (Kotlaba & Pouzar, 1964), and none of the original species included was truly resupinate. Although both this feature and the color of the context may not be decisive taxonomic characters on their own, when correlated with others, they may delimit fairly natural groups. If one relies, for instance, on context color for separation of taxa, then in this group (*Pyrofomes*, *Perenniporia* and *Loweporus*) one would have to accept three distinct genera, notwithstanding microstructural similarities.

In our case, both *Pyrofomes lateritius* and *Pyrofomes perlevis* agree with the diagnosis of *Pyrofomes* in what concerns fruit-body shape, whereas *Pyrofomes aurantiacus* and *Pyrofomes fulvo-umbrinus* do not. Granted that this feature alone is in many cases useless, its correlation with the microfeatures allow a separation of a rather homogeneus group which includes *P. demidoffi*, *P. perlevis*, *P. lateritius* and probably *P. tricolor* and *P. albomarginatus.*

Consequently we treat the latter species as members of *Pyrofomes*, and consider *Pyrofomes aurantiacus* and *Fomes fulvo-umbrinus* (= *Perenniporia gomezii*) as members of *Perenniporia*.

Acknoledgements

We wish to thank Dr.L. Ryvarden (Oslo, Norway) for his identification of our material, and Dr. Mario Rajchenberg (Esquel, Argentina) for critically reading the manuscript.

We acknowledge the assistance received from the authorities of the Administración de Parques Nacionales, Argentina, for permission to collect in the Iguazú Nat'l Park and guide service. The Argentine Nat'l Research Council provided funds for this research.

We also thank Dr. Edgardo Albertó for the photograph of the culture.

This is paper n° 68 of the PRHIDEB.

Literature

Boidin, J. 1954. Essai Biotaxonomique sur les Hydnés résupinés et les

Corticiés-Etude spéciale du comportement nucléaire et des mycéliums. 387 p. Thèse. Univ. de Lyon, Fac. des Sciences.

Bondartsev, A.S. 1971. The Polyporaceae of the European USSR and Caucasia. 896 p. Israel Program for Sci. Translation. Jerusalem.

Campbell, W.A..1938. The cultural characteristics of the species of *Fomes*. Bull. Torrey Bot. Cl. 65: 31-69.

Corner, E.J.H. 1989. Ad Polyporaceas V. Nova Hedwigia, Heft 96, 218 p.

David, A. & **Rajchenberg,** M. 1985. Pore fungi from French Antilles and Guiana. Mycotaxon 22(2): 285-325.

Gilbertson, R.L. & Ryvarden, L. 1987 North American Polypores. Vol. 2. Fungiflora. Oslo.

Kotlaba, F. & Pouzar, Z. 1964. Preliminary results on the staining of spores and other structures of Homobasidiomycetes in cotton blue and its importance for taxonomy. Feddes Repertorium 69 (2): 131-142.

Lloyd. C.G. 1912. Synopsis of the genus *Fomes*. Mycol. Writ. 4 Lett. No. 39:2.

Lloyd, C.G. 1915. Synopsis *Fomes*. Mycol. Writ. 4. p.231.

Munsell Color Co. 1954. Determination of soil color. From U.S. Dept. Agriculture Handbook 18. Soil Survey Manual.

Nobles. M.K. 1958. Cultural Characters as a guide to the taxonomy and phylogeny of the Polyporaceae. Can. J. Bot. 36: 883-926.

Nobles, M.K. 1965. Identification of cultures of wood-inhabiting Hymenomycetes. Can. J. Bot. 43: 1097-1139.

Pilát, A. 1936. Polyporaceae in **Kavina,** C. & **Pilát,** A. "Atlas des Champignons d'Europe", t.III. 624 p. Praha.

Rajchenberg, M. & Wright, J.E. 1982. Two new South American species of *Perenniporia* (Polyporaceae). Mycotaxon 15: 306-310.

Ryvarden, L. 1972. A critical checklist of the Polyporaceae in tropical East Africa. Norw. J. Bot. 19: 229-238.

Ryvarden, L. 1988. Type studies in the Polyporaceae 19. Species described by M.C. Cooke. Mycotaxon 31: 45-58.

Ryvarden L. 1989. Type studies in the Polyporaceae 21. Species described by C.G. Lloyd in *Cyclomyces*, *Daedalea*, *Favolus*. *Fomes* and *Hexagonia*.. Mycotaxon 35: 229-236.

Ryvarden. L. 1991. Genera of Polypores. Nomenclature and taxonomy. Synopsis Fungorum n° 5.Fungiflora, Oslo. 363p.

Ryvarden, L. & **Johansen** ,I. 1980. A preliminary polypore flora of East Africa. 633p.

Saccardo, P.A. 1888. Sylloge Fungorum. 6: 188. Patavii.

Stalpers, J.A. 1978. Identification of wood-inhabiting Aphyllophorales in pure culture. Stud. Mycol. 16: 1-248.

MYCOTAXON

Volume LX, pp. 317-321 October-December 1996

TAXONOMY OF FOMITOPSIS RUBIDUS COMB. NOV.

ANJALI ROY

Department of Botany, Visva-Bharati University, Santiniketan-731 235,
West Bengal, India

and

A. B. DE

Department of Botany, Burdwan Raj College, Burdwan-713 104,
West Bengal, India

SUMMARY

Morphological and cultural characters of Polyporus rubidus Berk. have been studied in detail and in the light of these findings the taxonomy of the fungus has been discussed. The new combination Fomitopsis rubidus (Berk.) Roy & De is proposed.

INTRODUCTION

Polyporus rubidus Berk. grows widely in India on dead hardwoods causing brown rot. The authors made several collections of this fungus and studied them morphologically and in culture including interfertility tests. The purpose of this paper is to describe, in detail, P. rubidus and to discuss its taxonomic satus.

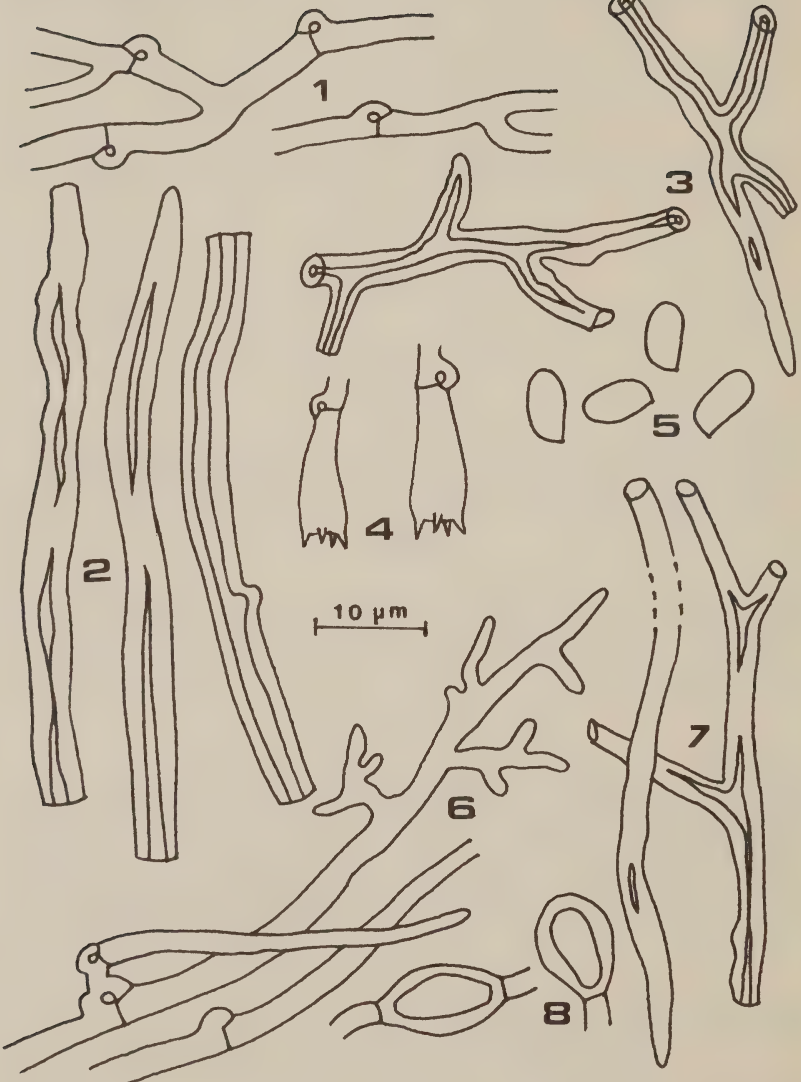
MATERIALS AND METHODS

Observations were based on fresh specimens collected by the authors. Microscopic characters of the basidiocarps were studied from freehand sections mounted in 10% KOH and stained with 1% Cotton blue. Cultures were established from context tissues of these basidiocarps and studied following the methods of Nobles (1948, 1965) and Nobles et al. (1957). Oxidase reactions were tested by the Bavendamm method as described by Davidson et al. (1938). Voucher specimens and cultures are maintained in the Mycological Herbarium of the Visva-Bharati University (VBMH).

DESCRIPTION OF BASIDIOCARP

Fomitopsis rubidus (Berk.) Roy & De, comb. nov.
Basionym : Polyporus rubidus Berk., Lond. J. Bot. 6 : 500, 1847.

Basidiocarp annual, rarely biennial to perennial, sessile or effused-reflexed, corky, becoming woody on age, dimidiate to semicircular, applanate, conchate or some ungulate, imbricate, 2.0-6.0 x 1.0-3.5 x 0.2-0.5 cm; upper surface cinnamon buff to pinkish brown, at


10 µm

first minutely tomentose, soon glabrous, zonate; margin thin, slightly incurved; context light pinkish brown, fibrous, 1.0-2.5 mm thick; hymenial surface light pinkish brown to pale cinnamon, pores small, circular to subangular, 6-8 per mm, pore tubes up to 3 mm long.

Hyphal system trimitic. Generative hyphae hyaline, thin-walled, clamped, 1.5-2.5 µm wide (Fig.1). Skeletal hyphae (Fig.2) hyaline or nearly so, thick-walled to subsolid, straight or flexuous, 2.5-4.5 µm wide. Binding hyphae (Fig.3) moderately branched, hyaline, thick-walled to solid, 2.5-4.5 µm wide. Basidia (Fig.4) clavate, 4-sterigmate, 10-15 x 3-5 µm. Basidiospores hyaline, thin-walled, smooth, cylindric-ellipsoid, apiculate, 5.0-7.5 x 3.5-4.0 µm (Fig.5), amyloid, cyanophilous.

SPECIMENS EXAMINED : VBMH 80701 on dead wood of Bambusa arundinacea Willd.; VBMH 80702 on dead wood of Tectona grandis L.f.; VBMH 80703 on log of Shorea robusta Gaertn. f.; VBMH 84704 on dead wood of Artocarpus lakoocha Roxb.; VBMH 84705 on dead wood of Castanea sativa Mill.; VBMH 85705 on dead wood of Dipterocarpus indicus Bedd.; VBMH 86706 on dead wood of Eucalyptus citriodora Hook.; VBMH 87707 on dead branch of Michelia sp.; VBMH 89708 on dead wood of Terminalia tomentosa Wright et Arn.

DISTRIBUTION IN INDIA : Dehra Dun (U.P.), Calcutta (W.B.), North and South India.

DESCRIPTION OF CULTURE

Growth characteristics : Growth slow, plates not covered in 6 weeks. Advancing zone even, hyaline, appressed or raised, aerial mycelium extended to the limit of growth. Mat white, cottony-floccose to wooly-floccose to floccose-felty or wooly-felty, with thin strands of mycelium raising along the wall of petri dish near inoculum. Reverse unchanged.

Oxidase reactions negative on both gallic acid and tannic acid agars, colony 4 cm in diameter on the former and 3.5 cm on the latter.

Microscopic characteristics : Advancing zone with hyphae hyaline, thin-walled, clamped, branched, often producing many short branches towards the distal ends, 1.5-5.0 µm wide (Fig.6). Aerial mycelium (a) hyphae as in the advancing zone; (b) fibre hyphae (Fig.7) hyaline, thick-walled to solid, branched and unbranched, 1.2-3.0 µm wide; (c)chlamydospores numerous, hyaline, thick-walled, smooth, terminal and intercalary, amyloid, cyanophilous, 7.5-12.0 x 3.5-8.0 µm (Fig.8).

SEXUALITY : The result of pairing of 20 monosporous cultures obtained from a fresh basidiocarp (VBMH 80703) shows the species to be bipolar with the following distribution of mating types among the basidiospores.

A_1 : 1, 5, 7, 8, 9, 10, 15, 17, 18, 19;

A_2 : 2, 3, 4, 6, 11, 12, 13, 14, 16, 20.

SPECIES CODE : 1. 3. 8. 34. 36. 38. 47. 54. 59 [following the system of Nobles (1965)].

CULTURES EXAMINED : VBMH 80701, 80702, 80703, 86706, and 89708.

Figs. 1-8. Fomitopsis rubidus. 1-5. Microscopic structures from basidiocarp. 1. Generative hyphae. 2.Skeletal hyphae. 3.Binding hyphae. 4.Basidia. 5.Basidiospores. 6-8.Microscopic structures from culture. 6.Thin-walled, clamped hyphae showing frequent branches towards the apex. 7.Fibre hyphae, branched and unbranched. 8.Chlamydospores.

DISCUSSION

From the foregoing description it is evident that this species possesses trimitic hyphal system. The hyphal system. i.e. monomitic, dimitic, or trimitic of a species has been considered to be taxonomically important in circumscribing genera (Bondartzeva 1961, Teixeira 1962, Donk 1964, Fidalgo and Fidalgo 1967). These authors would not include two species with different hyphal systems in the same genus. Thus *Polyporus rubidus* Berk. possessing a trimitic hyphal system, can not be placed under the dimitic genus *Polyporus* Mich. ex. Fr.

Ryvarden (1977) studied the type specimen of *Polyporus rubidus* Berk. and concluded that it was "*Trametes feei* (Fr.) Pat." Later Ryvarden and Johansen (1980) listed *P. rubidus* as a synonym of *T. feei*. Ryvarden (1977) and Ryvarden and Johansen (1980) regarded *P. rubidus* (=*T. feei*) as a member of the genus *Trametes* Fr. because *P. rubidus* resembles *Trametes suaveolens* (L.:Fr.) Fr., the type species of the genus *Trametes* Fr., by the following features : (i)pileus surface tomentose when young but becomes glabrous when old; (ii)pores circular to angular; (iii)hyphal system trimitic with clamped generative hyphae; and (iv)hyaline, thin-walled, smooth basidiospores. But our study reveals that *P. rubidus* causes brown rot, gives negative result in oxidase test and possesses bipolar type of sexuality whereas *T. suaveolens* causes white rot, gives positive result in oxidase test and possesses tetrapolar type of sexuality (Nobles 1965). These differences rule out the possibility of considering *P. rubidus* and *T. suaveolens* as congeneric.

Critical observations on the morphological, cultural and certain biological characters of *Polyporus rubidus* Berk. reveal its close relationship with *Fomitopsis pinicola* (Swartz: Fr.) Karst., the type species of the genus *Fomitopsis* Karst. Both produce effused-reflexed to sessile, woody, applanate to ungulate basidiocarps with circular pores. Both have a trimitic hyphal system with hyaline, clamped generative hyphae; ellipsoid-cylindric, hyaline, smooth, delicate-walled basidiospores; and cause brown rot of wood. The cultural characters of the two are similar as evident by comparing the species code of *F. pinicola* which is 1.3.8.32.34.36.38.44.46.54.55.59 with that of *P. rubidus* given above. Moreover, both the species give negative result in oxidase test and show bipolar sexuality. The great number of similarities between the two species indicate a phylogenetic relationship. Therefore, it is concluded that *Polyporus rubidus* and *Fomitopsis pinicola* are congeneric and the transfer to *Fomitopsis* is proposed.

ACKNOWLEDGEMENT

The authors are greatly indebted to Dr. J. Ginns, Curator, National Mycological Herbarium of Canada, for critically reviewing the manuscript.

REFERENCES

Bondartzeva, M.A. 1961. A critical review of the most recent classification of the family of the Polyporaceae. Bot. Zh. (Leningrad), 46: 587-593 (Translation, Canada Department of Agriculture No.73250, 1961).

Davidson, R.W., W.A. Campbell and D.J. Blaisdell. 1938. Differentiation of wood-decaying fungi by their reactions on gallic acid or tannic acid medium. J. Agric. Res. 57: 683-695.

Donk, M.A. 1964. A conspectus of the families of Aphyllophorales. Persoonia, 3: 199-324.

Fidalgo, O. and M.E.P.K. Fidalgo. 1967. Polyporaceae from Trinidad and Tobago. II. Mycologia, 59: 833-869.

Nobles, M.K. 1948. Studies in forest pathology VI. Identification of cultures of wood-rotting fungi. Can. J. Res., C-26: 281-431.

Nobles, M.K. 1965. Identification of cultures of wood-inhabiting Hymenomycetes. Can. J. Bot. 43: 1097-1139.

Nobles, M.K., R. Macrae and B.P. Tomlin. 1957. Results of interfertility tests on some species of Hymenomycetes. Can. J. Bot., 35: 377-387.

Ryvarden, L. 1977. Type studies in the Polyporaceae 10. Species described by J.M. Berkeley, either alone or with other authors, from 1844 to 1855. Norw. J. Bot. 24: 213-230.

Ryvarden, L. and I. Johansen, 1980. A preliminary polypore flora of East Africa. Fungiflora, Oslo, Norway.

Teixeira, A.R. 1962. The taxonomy of the Polyporaceae. Biol. Rev., 37: 51-81.

MYCOTAXON

Volume LX, pp. 323-326 October-December 1996

STRIGULA OCCULTA, A NEW SAXICOLOUS LICHEN FROM NEW ZEALAND

P. M. McCARTHY
Australian Biological Resources Study, Flora Section, GPO Box 636,
Canberra, A.C.T. 2601, Australia

W. M. MALCOLM
Micro-Optics Ltd, Box 320, Nelson, New Zealand

ABSTRACT

Strigula occulta P. M. McCarthy & Malcolm sp. nov. (lichenized Ascomycotina, Strigulaceae) is described from siliceous rock in New Zealand. The new lichen is related to *S. taylorii* (Carroll ex Nyl.) R. C. Harris and its allies from the Northern Hemisphere. A key to the saxicolous species of *Strigula* in Australia and New Zealand is provided.

INTRODUCTION

Although the species of *Strigula* Fr. are predominantly foliicolous, in recent years a growing number of corticolous and saxicolous taxa have been recognised mainly in southern Europe and Australasia (Roux & Bricaud 1993, McCarthy 1995). In this paper, a new saxicolous species is described from New Zealand. While *S. occulta* P. M. McCarthy & Malcolm is very different from other species known from the region, it is clearly related to the corticolous *S. taylorii* (Carroll ex Nyl.) R. C. Harris and a handful of other species in the Northern Hemisphere. A key is provided to the six saxicolous species of *Strigula* known from Australia and New Zealand.

METHODS

Hand sections and squash preparations were examined in water. Measurements of algae, thalline hyphae, paraphyses, ascospores and conidia were made at ×1000 magnification; those of the excipulum and asci were made at ×400 magnification. Ascospore dimensions are presented as mean values with extreme values in parentheses.

Strigula occulta P. M. McCarthy & Malcolm *sp. nov.* Fig. 1

Thallus epilithicus, viridis, continuus vel rimosus, 30–80 µm crassus. Algae *Trentepohlia*. Perithecia semiimmersa vel superficialia, nigra, partim vel plusminusve omnino thallo tecto. Involucrellum nigrum, 0.23–0.35(–0.4) mm diam., 30–130 µm

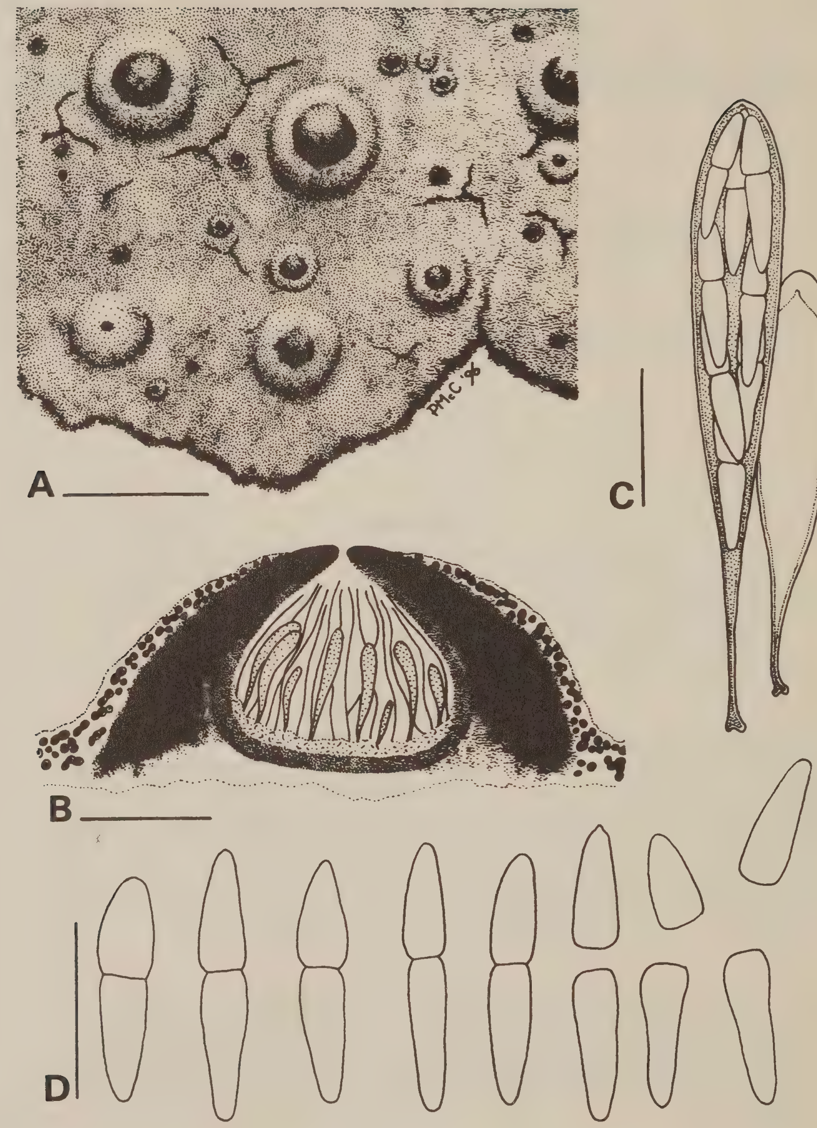


Fig. 1. *Strigula occulta* (isotype). A, Habit of thallus, perithecia and conidiomata; B, Vertical section of perithecium (semi-schematic); C, Mature and immature asci; D, Ascospores. Scale A = 0.5 mm, B = 0.1 mm, C, D = 20 µm.

crassum. Excipulum fuscoatrum, 15–25 µm crassum. Centrum 0.17–0.24 mm diametro. Asci 78–92 × 11–14 µm. Ascosporae 1-septatae, 22–32 × 4–6.5 µm, septo vulgo fissae. Microconidia 2–3 × 0.7–1 µm.

Type: New Zealand, South Island, Nelson, Brook Stream Track, NZMS 260 O27:343878, 41°19.1'S, 173°17.6'E, alt. 130 m, on tree-shaded siliceous rock in disturbed lowland forest, 22.x.1995, *W. M. Malcolm 2623* (CHR 507219–holotype; CANB–isotype).

Thallus crustose, epilithic, pale to medium green, determinate, continuous to rimose, matt to slightly glossy, smooth to minutely uneven, 30–80 µm thick, ecorticate. *Photobiont Trentepohlia*; cells 8–16 × 6–15 µm. *Mycobiont cells* 2–5 µm wide. *Prothallus* thin, dark grey to black. *Perithecia* numerous, semi-immersed to almost superficial, usually partly to almost entirely covered by a 20–60 µm thick thalline layer. *Perithecial apex* dull black, usually rounded. *Ostiole* inconspicuous. *Involucrellum* black, 0.23–0.35(–0.4) mm diam., 30–50 µm thick near the apex, 70–130 µm thick and spreading at the base, often subtending the excipulum. *Excipulum* dark brown to blackish, 15–25 µm thick. *Centrum* globose to depressed-ovate, 0.17–0.24 mm diam. *Paraphyses* simple to very sparingly branched, 1–1.5(–2) µm thick. *Periphyses* absent. *Subhymenium* c. 20 µm thick. *Asci* fissitunicate, elongate-clavate, 78–92 × 11–14 µm; apex rounded or subacute; ocular chamber minute, convex to tubercular, visible only in immature asci. *Ascospores* colourless, 8 per ascus, elongate-fusiform, 1-septate, 22–32 × 4–6.5 µm, constricted at the septum, lacking appendages; apices usually bluntly pointed, occasionally rounded, rarely apiculate; cells similar or distal cell longer and slightly broader than proximal cell, usually separating at or after dehiscence; demispores (10.5–)14(–18) × (4–)5(–6.5) µm (100 measured); contents clear or guttulate. *Conidiomata* numerous, semi-immersed, black, 60–120 µm diam. *Microconidia* elongate-ellipsoidal to fusiform, 2–3 × 0.7–1 µm. *Macroconidia* not seen.

Notes: Strigula occulta is somewhat similar to the corticolous *S. taylorii* and its allies from Europe and North America, all of which have a well-defined thallus, small perithecia and elongate 1-septate ascospores that frequently break at the septum (Swinscow 1963, Roux & Bricaud 1993). However, the new species is distinguished by its saxicolous thallus, broader perithecia that are partly or almost entirely overgrown by the thallus, dark excipulum, discontinuously longer asci, broader ascospores and smaller microconidia.

Strigula occulta is known only from its type locality at the north end of the South Island of New Zealand. It grows on tree-shaded siliceous rocks on a steep east-facing slope in humid, disturbed, lowland forest which is dominated by *Hedycarya arborea*, *Coprosma grandifolia* and *Alectryon excelsus* in the overstorey. It is associated with *Pannaria immixta*, *Porina guentheri*, *P. leptalea*, *P. partita*, an undescribed *Porina* sp. (McCarthy & Malcolm, in prep.), *Leptogium* sp. and several unidentified mosses and liverworts. The specific epithet is derived from the Latin *occultus* (hidden), in reference to the perithecia which are frequently covered by a layer of thallus.

KEY TO THE SAXICOLOUS SPECIES OF *STRIGULA* IN AUSTRALIA AND NEW ZEALAND

1a Ascospores with transverse septa only **2**
1b Ascospores muriform **5**

2a Ascospores 1-septate **3**
2b Ascospores mostly 3–7-septate **4**

3a Perithecia 0.15–0.28 mm diam. Asci 45–58 × 6–8 µm. Ascospores 6–10 × 2–3.5 µm; cells not separating at maturity [NE Australia]
S. minutula P. M. McCarthy
3b Perithecia 0.23–0.4 mm diam. Asci 78–92 × 11–14 µm. Ascospores 22–32 × 4–6.5 µm; cells often separating at maturity [New Zealand]
S. occulta P. M. McCarthy & Malcolm

4a Ascospores (1–)3(–5)-septate, 15.5–26.5 × 4.5–8.5 µm [12–20 × 3–6 µm in *S. affinis* (Roux & Bricaud 1993)]. Macroconidia 3-septate, 12 –21 × 2.5–3.5 µm. Thallus calcicolous [New Zealand]
S. aff. ***affinis*** (Massal.) R. C. Harris

4b Ascospores 7-septate, 22–33 × 5.5–7.5 µm. Macroconidia 5–7-septate, 15–25 × 3–4.5 µm. Thallus silicolous [E Australia, New Zealand]
S. stigmatella var. ***alpestris*** (Vezda) Coppins

5a Perithecia 0.32–0.58 mm diam. Ascospores submuriform, 23–36 × 7–11.5 µm [NE Australia, Lord Howe Is., New Zealand]
S. australiensis P. M. McCarthy

5b Perithecia 0.42–0.82 mm diam. Ascospores muriform, 37–63 × 10–19 µm [New Zealand] **S. johnsonii** P. M. McCarthy

LITERATURE CITED

McCarthy, P. M. (1995). New saxicolous species of *Strigula* Fr. (lichenised Ascomycotina, Strigulaceae) from Australia and New Zealand. *Muelleria* **8,** 323–329.

Roux, C. & Bricaud, O. (1993). Studo de la genro *Strigula* (Lichenes, Strigulaceae) en S-Francio. Graveco de la makrokonidioj. *Bull. Soc. Linn. Provence* **44,** 117–134.

Swinscow, T. D. V. (1963). Pyrenocarpous lichens: 5. *Lichenologist* **2,** 167–171.

MYCOTAXON

Volume LX, pp. 327-360 October-December 1996

XYLARIA SPECIES FROM PAPUA NEW GUINEA: CULTURAL AND ANAMORPHIC STUDIES

Katleen Van der Gucht

Botany Laboratory, Department M.S.E., University of Gent, K.L.
Ledeganckstraat 35, 9000 Gent, Belgium

ABSTRACT

Cultural and anamorphic characteristics are described and illustrated for 15 *Xylaria* taxa collected in Papua New Guinea. For 6 species the anamorph as found in nature is described and compared with the anamorph as obtained in culture. Based on these cultural and anamorphic studies *Xylaria allantoidea*, *X. badia*, *X. cubensis*, *X. laevis* and *X. poitei* seem to be closely related and belong to the *X. cubensis* group; *X. multiplex* shows great similarities with *X. grammica*, *X.* cf. *pallida* and *X. papulis*; *X. luteostromata* appears to be allied to *X. feejeensis*.

INTRODUCTION

Members of *Xylaria* are frequently encountered in their asexual states in the field and are commonly isolated as endophytes (Rodrigues et al. 1993; Callan & Rogers 1993). These states can be identified only after comparison with anamorphs and cultures that originated from identified teleomorphic material. Therefore, well-established teleomorph-anamorph connections are invaluable as a frame of reference. In this paper cultural and anamorphic data are presented for 15 *Xylaria* taxa in order to complement and supplement our understanding of these fungi.

MATERIALS AND METHODS

Air-dried specimens were used to start cultures, following the collecting procedure described by Kendrick et al. (1979). The culture technique employed is a slight modification of the technique used by Callan & Rogers (1990). Most of the cultures were initiated from multiple ascospores dissected from perithecia that had been rehydrated with sterile aqua destillata. A few cultures were initiated from small parts of anamorphs found in nature. For this purpose, a small piece of the conidiome situated in the conidiogenous region, including conidia, was used. Cultural characteristics were studied on colonies growing on 9 cm diam plastic Petri dishes

containing oatmeal agar (Difco), unless another type of agar is indicated in the description. The plates were incubated at ca. 20°C under alternating daily periods of 12 h light and 12 h darkness. Whenever possible, the anamorph derived from cultures was compared with the anamorph as found and collected in nature. Colour designations used throughout the taxonomic descriptions are from Kornerup & Wanscher (1978), and appear in parentheses following the colour names.
Dried cultures are retained in the herbarium (GENT) together with the specimens from which they are derived. A collection of living cultures was deposited in MUCL (Mycothèque de l'Université Catholique de Louvain-La-Neuve).

Xylaria allantoidea (Berk.) Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1: 127 (1851). - Pl. 1a-c, Pl. 2a-c.

CULTURAL CHARACTERISTICS

COLONIES reaching edge of Petri dish in 3-4 weeks, at first white to light orange-white (6)(A)(2) with plumose margins, later becoming velvety, often with faint concentric zones, orange-white to brownish grey (4)(E)(2) towards the centre. Reverse yellowish brown to dark brown towards the centre (5)(D)(4). Exudate colourless to light orange. HYPHAE parallel, sparingly branched, septate, hyaline, smooth, locally becoming dark brown, closely septate, becoming irregularly branched, and finally breaking into segments. STROMATA developing after 1 month, especially abundant at the colony margin, usually cylindrical to somewhat flabelliform, at first light orange-white with a brownish orange (5)(C)(3) base, in the somewhat broadened uppermost half of the stromata becoming grey (8)(B)(1) due to conidia production, up to 5 mm high x 1-4 mm diam., with the apex remaining sterile and proliferating. CONIDIOPHORES in palisades, repeatedly branched, hyaline to subhyaline, smooth, 2-3 µm diam. CONIDIOGENOUS CELLS terminal, cylindrical, hyaline, smooth, 30-40 x 2.5-3 µm, bearing in the upper part small circular refractile conidial scars. CONIDIA acropleurogenous, obovoid to ellipsoid, with a flattened circular abscission scar at the base, hyaline, smooth, 4.5-6.5(7) x (2.5)3-3.5 µm.
COLONIES grew slowly when started from a piece of the anamorph found in nature: up to 5.5 cm diam. in 3 weeks, greyish orange (6)(B)(3) and concentrically zoned, in the centrum covered with white cottony mycelium. STROMATA, CONIDIOPHORES, CONIDIOGENOUS CELLS and CONIDIA as described from the cultures derived from ascospores.

ANAMORPH AS FOUND IN NATURE

Anamorph formed on stromata distinct from the teleomorphic stromata. ANAMORPHIC STROMATA cylindric-fusoid, pale yellow to greyish yellow (4)(A-B)(3), up to 3.5 cm high x 1-2 mm diam. Conidium-bearing regions covering the entire surface of the stromata. CONIDIOPHORES, CONIDIOGENOUS CELLS and CONIDIA as described from conidiomata produced in culture.

For description of corresponding teleomorph see Van der Gucht (1995).

OTHER DESCRIPTIONS AND ILLUSTRATIONS: Rogers 1984: 921, figs. 6, 8, 9, 24-26

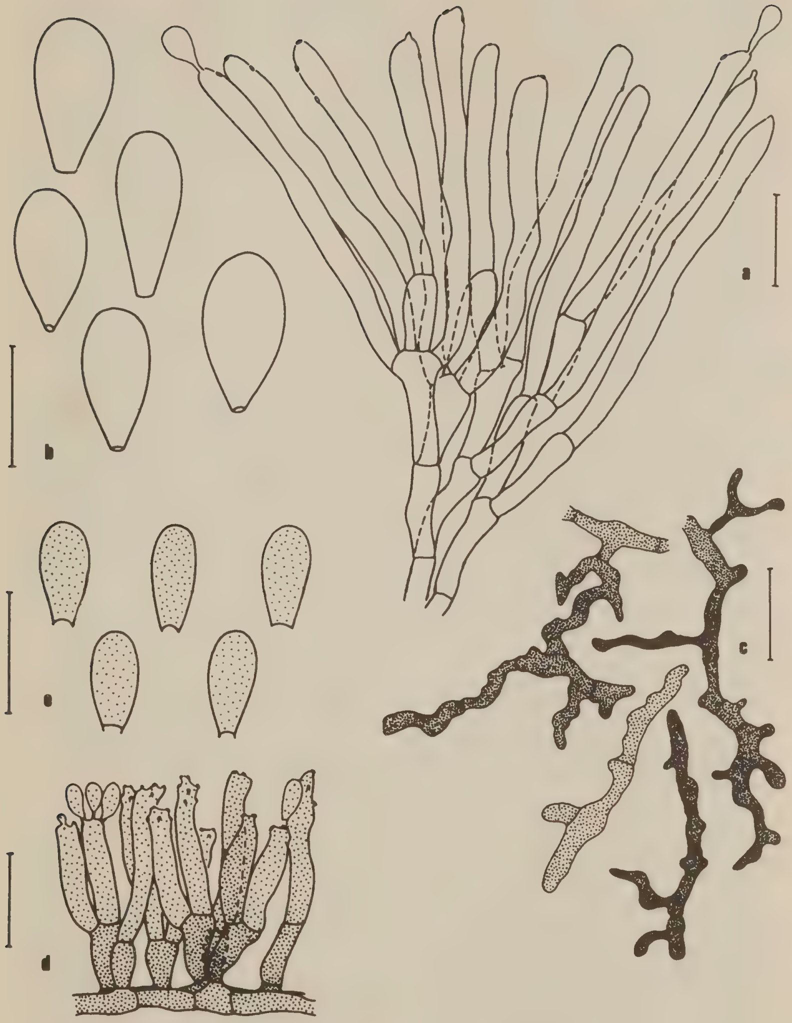


Plate 1: *Xylaria allantoidea* - ANAMORPH as formed in culture (92-1046): a. conidiophores (scale bar = 10 µm), b. conidia (scale bar = 5 µm), c. brown hyphae with short protuberances as formed in aging colonies (scale bar = 10 µm); *Xylaria badia* - ANAMORPH as formed in culture (89-518c): d. conidiophores (scale bar = 10 µm), e. conidia (scale bar = 5 µm).

(anamorph in culture); Callan & Rogers 1990: 346, figs. 8-16 (sub *Xylaria* cf. *allantoidea* (Berk.) Fr.) (anamorph in culture); Rodrigues et al. 1993: 120, fig. 2. (anamorph in culture).

SPECIMENS EXAMINED AND CULTURED: EAST SEPIK PROVINCE: Watam, 3°55'S & 144°33'E, sea level, rain forest near the coast, on dead wood, 17.5.1992, Vyverman & Vyverman 92-1046 (culture) (GENT). Taway, 4°2'S & 144°13'E, elev. 40-60 m, lowland hill forest, on dead wood, 14.5.1992, Van der Gucht & De Meester 92-886 (culture) & 92-900 (culture) (GENT). Between Marienberg and Bien, 3°58'S & 144°18'E, mixed flood-plain forest near the border of River Sepik, on dead wood, 16.5.1992, Van der Gucht & De Meester 92-983 (culture) (GENT).
MADANG PROVINCE: Finisterre Range, near Naru River ford on road Wau-Lae, 5°27'S & 145°32'E, elev. 350 m, rain forest, on dead wood, 27.10.1989, Van der Gucht 89-1269 (anamorphic state) (culture of the anamorph) (GENT). Road to Bunapas, 9 km beyond the bifurcation Bogia-Bunapas, 4°11'S & 144°47'E, sea level, rain forest, on dead wood, 30.10.1989, Van der Gucht & De Meester 89-1392 (anamorphic state) (GENT). Awar, 4°6'S & 144°50'E, sea level, coastal rain forest, on dead wood lying on the ground, 18.5.1992, Van der Gucht & De Meester 92-1054a (culture) (GENT). Cape Barschtsch, near lake Babel, 5°4'S & 145°48'E, sea level, coconut plantation, on a dead coconut stem lying on the ground, 24.5.1992, Van der Gucht 92-1216 (culture) (GENT).

Rogers (1985) suggested *X. allantoidea* as a probable member of the *X. cubensis* group which are characterized by conidia formed upon special anamorphic stromata that are usually produced earlier in the year than the teleomorphic stromata. My observations are in agreement with this suggestion in that they indicate that anamorphs and teleomorphs are produced on independent structures in this taxon. Indeed, I could not find any remnants of conidial structures on the young, immature teleomorphic stromata, which were found on the same log with the anamorphs. However, field observations throughout a full season of development are necessary before one can be certain that the anamorphic stromata stay anamorphic.
Further evidence for placing *X. allantoidea* in the *X. cubensis* group is found in the cultural characteristics. Cultures of *X. allantoidea* strongly resemble those of *X. cubensis* in several respects. Growth rate, colour, and the production of both flabellate and cylindrical stromata are shared characters.

Xylaria badia Pat., J. Bot. (Morot) 5: 319 (1891). - Pl. 1d-e, Pl. 2g-h.

CULTURAL CHARACTERISTICS
COLONIES reaching edge of a 9 cm diam Petri dish in 3 weeks, at first thin, hyaline, appressed, the centre becoming grey (28)(C-D)(1) and furrowed, at the margins with

---

Plate 2: *Xylaria allantoidea* - ANAMORPH as formed in culture (92-1046): a. culture started from ascospores (9 cm diam. Petri dish), b-c. conidiomata (x 1.5); *Xylaria poitei* - ANAMORPH as formed in culture (92-998): d. culture (9 cm diam. Petri dish), e. cylindrical stromata bearing conidia (x 4), f. minute subglobose stromata bearing conidia (x 3); *Xylaria badia* - ANAMORPH as formed in culture (89-518c): g. culture (9 cm diam. Petri dish), h. conidiomata (x 6).

a
d
b
e
f
g
h

patches of white thicker mycelium. Exudate orange. Reverse golden brown (5)(D)(6) to yellowish brown (5)(E)(4). HYPHAE sparingly branched, septate, hyaline, smooth, ± 2 µm diam. STROMATA formed after 3 weeks at the margins of the colony, cylindrical, minute, up to 4 mm high x 1-2 mm diam, at first white, becoming brownish grey (5)(D)(2). Conidium-bearing regions covering the entire surface of the stromata except for the apex which remains sterile. CONIDIOPHORES in palisades, dichotomously branched at the base, brown, smooth, up to 25 µm long x 2-2.5 µm diam. CONIDIOGENOUS CELLS terminal, cylindrical, subhyaline to light brown, smooth, 12-16 x 2.5-3 µm, bearing denticulate conidial scars apically and laterally. CONIDIA acropleurogenous, obovoid, with a concave circular abscission scar at the base, subhyaline, smooth, 3.5-4.5 x 1.8-2 µm.

For description of corresponding teleomorph see Van der Gucht (1995).

SPECIMENS EXAMINED AND CULTURED: MADANG PROVINCE: Hansa Bay, Laing Island, 4°10'S & 144°52'E, sea level, coralligeneous island 700 x 100 m, on dead wood of bamboo, 3.10.1989, Van der Gucht K. 89-518c (culture) (GENT). Finisterre Range, 40 km beyond the bridge over the Gogol River on road Madang-Lae, 5°28'S & 145°29'E, elev. 500 m, rain forest, on dead wood of bamboo, 12.11.1989, Van der Gucht K. 89-1920 (culture) (GENT).

This fungus resembles *X. cubensis* in general appearance. Based on its anamorphic and teleomorphic characteristics it probably belongs to the *X. cubensis* group (Van der Gucht, in press).
X. badia seems to be restricted to bamboo in Papua New Guinea.

Xylaria cubensis (Mont.) Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1: 126 (1851). - Pl. 3a-c, Pl. 4a-f.

CULTURAL CHARACTERISTICS
COLONIES reaching edge of Petri dish in 2-3 weeks, at first white with an orange centre (6-7)(A-B)(3-6), appressed, with faintly zonate white margins, often furrowed, later darkening from centre outwards, becoming brownish grey to black (6)(E)(2-3) and covered by lanose or cottony mycelium (white to tan hyphae). Reverse light orange to greyish orange (5-6)(A-C)(4). Exudate yelowish orange. HYPHAE parallel, sparingly branched, septate, hyaline, smooth, with age becoming brown, densely septate and easily breaking apart. Clusters of dark brown, swollen thick walled cells, remaining in chains are formed in aging colonies. CONIDIOGENOUS STRUCTURES formed either on small tufts in the centre of the colony, or on cylindrical to flabelliform stromata. TUFTS formed after 20 days, subglobose, brownish grey to grey (6)(D-E)(1-2) due to conidia production over the whole surface, 1-2 mm diam. STROMATA developing after 3 weeks, throughout the whole colony (at surface and periphery of colony), cylindrical or with a flabelliform conidiogenous upper part, at first white to orange-white with a black base, becoming pink (6)(A)(2) or grey (5)(B)(6) in areas of conidial production, up to 25 mm high x 1-3 mm diam. Conidium-bearing regions usually starting in the somewhat broadened uppermost half of the stromata later covering the entire surface of the stromata. Occasionally

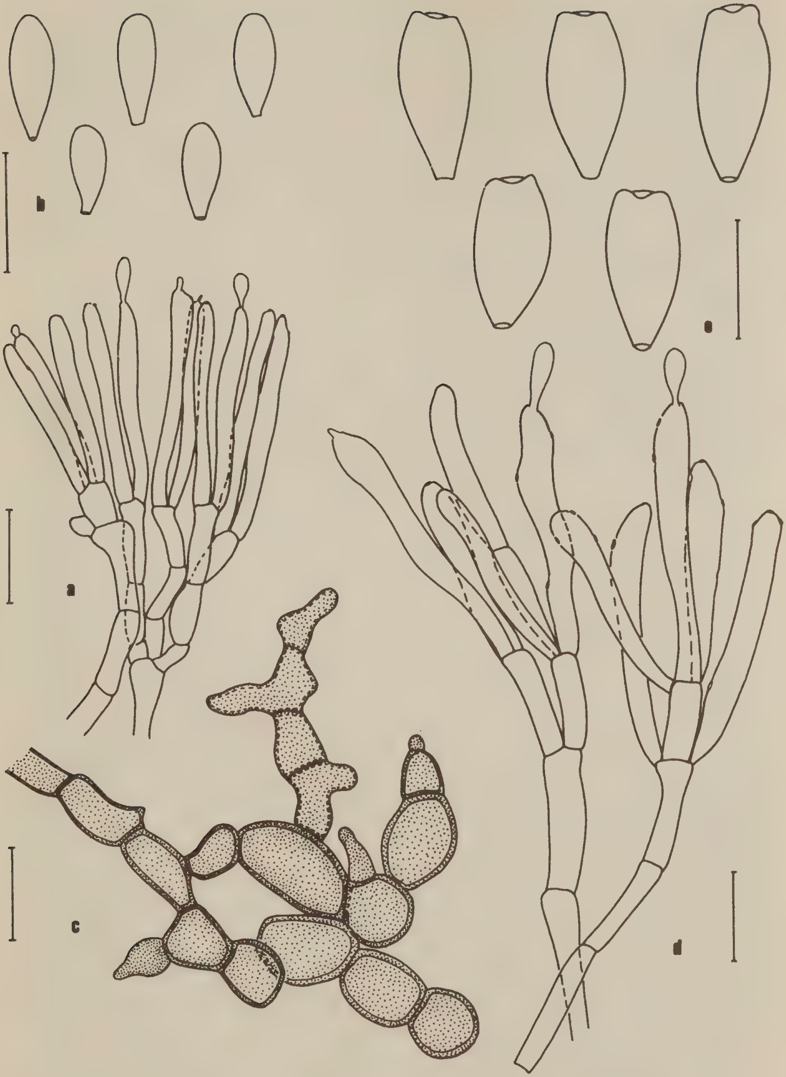


Plate 3: *Xylaria cubensis* - ANAMORPH as formed in culture (92-1236): a. conidiophores (scale bar = 10 µm), b. conidia (scale bar = 5 µm), c. clusters of swollen thick walled, dark brown cells, remaining in chains (scale bar = 10 µm); *Xylaria poitei* - ANAMORPH as formed in culture (92-998): d. conidiophores (scale bar = 10 µm), e. conidia (scale bar = 5 µm).

the stromata remained sterile. No apparent morphological difference between conidiogenous structures from either location (tufts, stromata). CONIDIOPHORES in dense palisades, repeatedly branched, hyaline to subhyaline, smooth, 2.5-3 µm diam. Palisades sloughing off in dusty flakes that accumulate in small heaps underneath the stromata. CONIDIOGENOUS CELLS terminal, cylindrical, hyaline to subhyaline, smooth, 9.5-15 x 2-3 µm, bearing circular refractile conidial scars apically and laterally. CONIDIA acropleurogenous, obovoid to ellipsoid, with a flattened circular abscission scar at the base, hyaline, smooth, (3)3.5-5(6) x (1)1.5-2(3) (avg. ± SD: 4.41 ± 0.58 x 1.65 ± 0.18 µm).
COLONIES started from a piece of the anamorph found in nature showed a more luxuriant growth of the anamorphic stromata. The other characteristics were identical to the cultures started from ascospores.

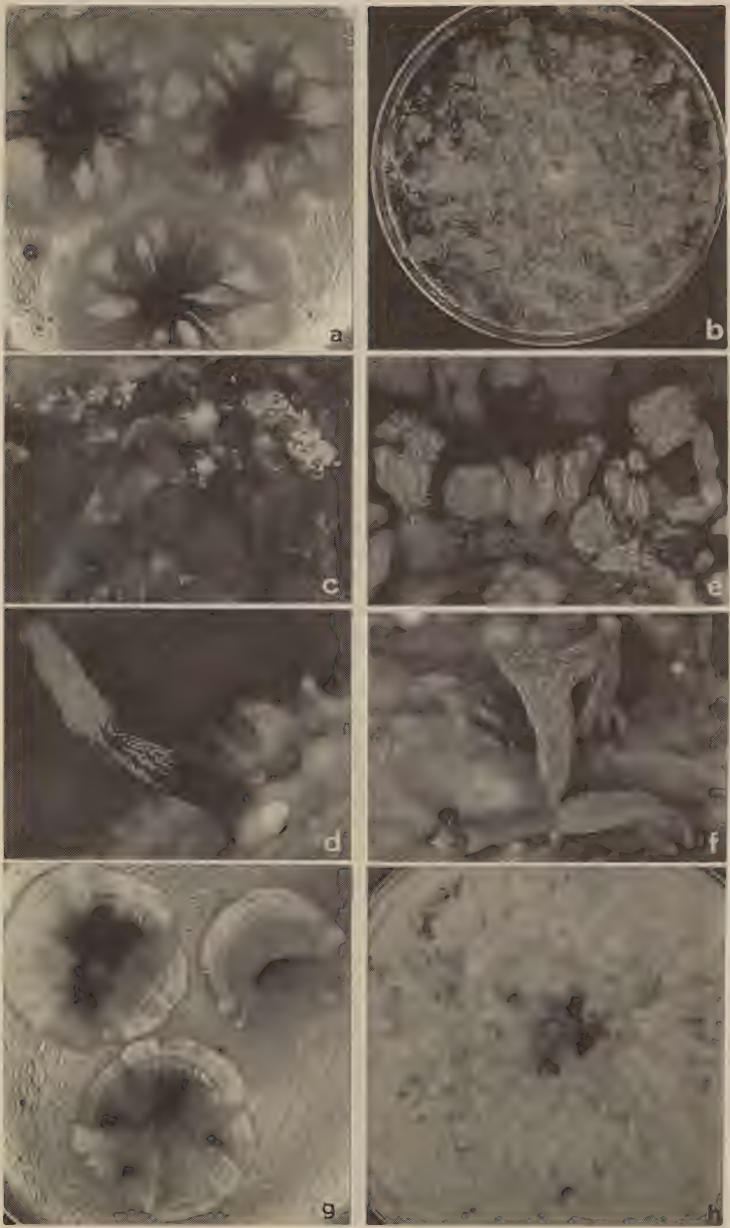
ANAMORPH AS FOUND IN NATURE
Anamorph formed on stromata distinct from the teleomorphic stromata. ANAMORPHIC STROMATA erect, with black, villose bases and flabellate, foliate or more or less cerebriform, orange-white (5)(A)(2) or greyish (5)(B-C)(1) fertile portions, 3-7 mm total height x 2-8 mm diam. CONIODIOPHORES, CONIDIOGENOUS CELLS and CONIDIA as described from anamorphic stromata produced in culture.

For description of corresponding teleomorph see Van der Gucht (1995).

OTHER DESCRIPTIONS AND ILLUSTRATIONS: Martin 1970: 95, pl. V:14 (cultural characteristics); Rogers 1984: 912-921, figs. 1-3, 10-15, 16-20, 27, 28 (anamorph in culture and nature); Rogers & Samuels 1986: 617-619, fig. 1, 6c (anamorph in culture); Callan & Rogers 1990: 362, figs. 59 & 60 (sub *Xylaria* sp. aff. *cubensis* (Mont.) Fr.) (anamorph in culture); Rodrigues et al. 1993: 124, fig. 6. (anamorph in culture).

SPECIMENS EXAMINED AND CULTURED: MADANG PROVINCE: Hansa Bay, Laing Island, 4°10'S & 144°52'E, sea level, coralligeneous island 700 x 100 m, S.W. side of the island, 9.5.1992, Van der Gucht K. 92-817(*) (culture) (GENT). Finisterre range, near Naru River ford on road Madang-Lae, 5°24'S & 145°38'E, elev. 200 m, rain forest, on dead wood, 22.10.1989, Van der Gucht K. 89-968 (anamorphic state) (GENT). North of Alexishafen, between Dänip & Midipur, 5°5'S & 155°46'E, sea level, secondary disturbed rain forest in association with coconut plantation, on dead decorticated wood, 2.5.1992, Van der Gucht K. & De Meester L. 92-504 (culture) (GENT). Amron village, 5°7'S & 145°45'E, elev. 40 m, secondary rain forest with lots of palms, on dead decorticated wood, 3.5.1992, Van der Gucht K. & De Meester L. 92-521(*) (culture), 92-534 (anamorphic state) (culture) (culture from anamorph), 92-535 (culture) & 92-542 (culture) (GENT). Balek Wildlife Sanctuary, 5°19'S & 145°43'E, elev. 0-50 m, lowland rain forest, on dead wood, 4.5.1992, Van der Gucht K. & De Meester L. 92-598 (culture), 92-596(*) (culture) (GENT). Awar, 4°6'S & 144°50'E, sea level, lowland rain forest near the sea with lots of palms, on dead wood, 18.5.1992, Van der Gucht K. & De Meester L. 92-1050(*) (culture), 92-1052 (culture), 92-1058 (culture), 92-1079 (culture), 92-1086 (culture).

Plate 4: *Xylaria cubensis* - ANAMORPH as formed in culture (92-1236): a. young culture started from ascospores (9 cm diam. Petri dish), b. culture started from a piece of the anamorph, c. subglobose tufts bearing conidia (x 6), d. sterile stroma (x 1.5), e-f. conidiomata (x 1.5); *Xylaria laevis* - CULTURAL CHARACTERISTICS (92-1473): g. young culture (9 cm diam. Petri dish), h. sterile stromata (x 1.5).


a
b
c
e
d
f
g
h

Eo loco, 20.5.1992, Van der Gucht K. & De Meester L. 92-1126(*) (culture), 92-1128 (culture), 92-1145(*) (culture), 92-1168 (culture), 92-1171(*) (culture). Ramu Region, Brahman, 5°46'S & 145°22'E, elev. 150 m, disturbed forest near Brahman mission, on dead wood, 25.5.1992, Van der Gucht K. & De Meester L. 92-1236 (culture) (GENT). Ramu Region, 5°44'S & 145°20'E, elev. 150 m, alluvial flood-plain forest, on dead wood, 26.5.1992, Van der Gucht K. & De Meester L. 92-1253 (culture) (GENT). Baiteta, 5°0'S & 145°44'E, elev. 50 m, rain forest with lots of young trees, on dead wood, 2.6.1992, Van der Gucht K. & De Meester L. 92-1558 (culture) & 92-1562 (culture) (GENT). Eo loco, 2.6.1992, Vyverman W. & Vyverman R. 92-1592(*) (culture) (GENT).

MOROBE PROVINCE: Lae, 4 km beyond bridge over the Markham River direction Wau, 6°42'S & 146°51'E, sea level, rain forest, dead wood, 8.11.1989, Van der Gucht K. & De Meester L. 89-1658 (anamorphic state) (GENT).

The * (see specimens examined) indicates a smaller growth form with the stromata usually occurring gregariously and characterised by a surface cracked in a polygonal pattern. This growth form was found in dryer habitats (Van der Gucht 1995). Cultures isolated from both growth forms were identical. These cultures showed characteristics almost identical with those described in the literature. A characteristic never mentioned before, however, are the conidial tufts formed in the centre of several colonies. Such tufts have been observed together with non-conidial stromata, together with conidium bearing stromata, or without stromata.

The typical *Xylocoremium flabelliforme* anamorph was found only three times in nature together with immature or deteriorating teleomorphic stromata. This is an indication that mature teleomorphic stromata and mature anamorphic stromata usually do not occur during the same season. The same observation was done by Rogers (1984). Anamorphic stromata of *Xylocoremium flabelliforme* are usually unconnected with the *Xylaria cubensis* teleomorph. Læssøe (personal communication) indicates, however, that both forms are common simultaneously in Ecuadorean rain forests.

According to Rogers (personal communication) the presence of pink and of grey conidial masses, respectively, might indicate that several taxa are, in fact, represented here, with the cultures having grey conidia produced on stromata representing *X. laevis*. Cultures from taxa that I consider to be *X. laevis*, however, differ in general appearance (see description of *X. laevis*). In any case, many problems still remain in this group.

Xylaria curta Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1: 126 (1851). - Pl. 13h.

CULTURAL CHARACTERISTICS

COLONIES reaching edge of Petri dish in 2-3 weeks, at first pure white, velvety with distinct plumose margins, darkening from centre outwards to olive-brown (4)(F)(5), later dull black, in the centre becoming overlain by thin white aerial mycelium. Exudate colourless to light orange. HYPHAE sparingly branched, septate, at first hyaline, later becoming brown, smooth, ± 2 µm diam. STROMATA produced within 3 weeks, at first in a concentric zone around the centre, later covering the whole surface of the colony, abundant, long cylindrical, unbranched, at first white, later covered from base upwards with villose black hyphae, up to 6 cm long x 0.3-1 mm diam. The cultures remained sterile.

For description of corresponding teleomorph see Van der Gucht (1995).

SPECIMEN EXAMINED AND CULTURED: MADANG PROVINCE: Ramu Region, Road to Bundi, 5°44'S & 145°20'E, elev. 150 m, alluvial flood-plain forest, on dead wood, 27.5.1992, Van der Gucht K. & De Meester L. 92-1433a (culture) (GENT).

As has been discussed by Læssøe (1987), there have been extensive misapplications of the name *X. curta*. I consider the material collected as true *X. curta*, characterized by the presence of the pronouncedly white to yellow ectostromal squamules (Van der Gucht 1995).
The cultures established by me remained sterile. In general appearance, they correspond to the description given by Callan & Rogers (1990) sub *Xylaria* cf. *curta* (tropical collection).
The descriptions of cultural characteristics given by Rogers (1983) and Callan & Rogers (1990) sub *Xylaria curta* are best considered to be cultures of *X. corniformis* (Fr.) Fr. fide Callan & Rogers (1993). They differ from the above-mentioned cultures in that they lack distinctive plumose margins and in that conidiogenous structures are produced in culture.

Xylaria feejeensis (Berk.) Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1: 128 (1851). - Pl. 5a-c, Pl. 13f-g.

CULTURAL CHARACTERISTICS
COLONIES reaching edge of Petri dish in 3 weeks, at first white, very thin with fine texture and a distinct margin, with centre becoming faint yellow (4)(A)(1-2), later darkening to reddish grey (7)(B)(2), and becoming furrowed with radiating depressions, floccose. Reverse pale yellow (4-5)(A)(3-4). Exudate colourless or yellow to orange. HYPHAE sparingly branched, septate, highly coiled or straight, at first hyaline, later becoming brown, ± 2 µm diam. STROMATA formed after 3 weeks at the margin of the colonies, cylindrical, branched, at first white, later covered from base upward with villose black hyphae, 5-15 mm high x 2-3 mm diam. Conidium-bearing regions developing on upper part of stromata, which turns pale tan (4)(C)(3) due to conidial production. CONIDIOPHORES in dense palisades, branched dichotomously, hyaline, smooth, 2-3 µm diam. CONIDIOGENOUS CELLS terminal, cylindrical, hyaline, smooth, 8-12 x 2-3 µm, bearing circular refractile conidial scars apically and laterally. CONIDIA acropleurogenous, obovoid to ellipsoid with a flattened circular abscission scar at the base, hyaline, smooth, (7)7.5-9(9.5) x 4-4.5 µm. Conidia pale tan in mass, often accumulating in conspicuous heaps beneath stromata.

For description of corresponding teleomorph see Van der Gucht (1995).

OTHER DESCRIPTIONS AND ILLUSTRATIONS: Martin 1970: 120, pl. VI:7, VII:13 (anamorph in culture); Callan & Rogers 1990: 358, figs. 30-32 (anamorph in culture).

SPECIMEN EXAMINED AND CULTURED: MADANG PROVINCE: Awar, 4°5'S & 144°50'E, sea level, coastal woodland (with lots of palms and lianes), on dead tree lying on the ground, 20.5.1992, Van der Gucht K. & De Meester L. 92-1137 (culture) (GENT).

There are some differences in the characteristics of the cultures established by me compared to data in the literature (Martin 1970; Callan & Rogers 1990). The conidia of the Papua New Guinean material are larger (7.5-9 x 4-4.5 µm) than those measured by Martin (1970; 6.2-7.5 x 3.1-3.7) and by Callan & Rogers (1990; 5-6 x (2)3 µm), and they were produced on cylindrical stromata with black villose bases instead of on pulvinate stromata (prior to the production of villose basal hyphae) or on small tufts independent of the stromata as oberved by Callan & Rogers (1990). However, this latter difference may be only a variation in conidial production. My own experience with *Xylaria* cultures, indeed, indicates that variation may exist among the kinds of conidiomata produced. One species may produce different types of conidiomata ranging from small tufts directly on the mycelium to cylindrical stromata (e.g. *X. cubensis*).
None of the former studies mentions the striking coiled hyphae of the mycelium.

Xylaria frustulosa (Berk. & M.A.Curtis) Cooke, Grevillea 12: 5 (1883). - Pl. 6a-b.

CULTURAL CHARACTERISTICS
COLONIES on malt extract agar reaching a diameter of 2.5 cm in 4 weeks, at first white, with a distinct margin, floccose with local aggregations of mycelium, later becoming greyish brown (6)(D-E)(3). Reverse pale orange (5)(A)(3) to brown (6)(E)(4). Exudate colourless. HYPHAE sparingly branched, septate, hyaline, smooth, ± 2 µm diam. CONIDIOGENOUS STRUCTURES produced on minute, cushion-like tufts, formed in the centre of the colonies after 3 weeks. Tufts villose and brown (5)(C)(3) when young, becoming brownish grey (5)(D)(2) due to conidial production, 1-1.5 mm diam. Conidiogenous regions covering the entire surface of the tufts. CONIDIOPHORES in loose palisades, dichotomously branched, subhyaline to light brown, smooth, 90-120 µm long x 2-3 µm diam. CONIDIOGENOUS CELLS terminal, cylindrical, subhyaline, smooth, 20-25 x 2-2.5 µm, bearing the conidial scars apically and laterally. CONIDIA acropleurogenous, clavate, with a flattened to concave abscission scar at the base, hyaline, smooth, 6.5-9.5(11) x 2.5-3.5 µm (avg. ± SD: 8.74 ± 1.39 x 2.85 ± 0.04 µm).

For description of corresponding teleomorph see Van der Gucht (1995).

OTHER DESCRIPTION AND ILLUSTRATIONS: Jong & Rogers 1970: 851-855, figs. 1-7 (sub *Penzigia frustulosa* (Berk. & M.A.Curtis) J.H.Mill.) (anamorph in culture).

SPECIMENS EXAMINED AND CULTURED: EAST SEPIK PROVINCE: Watam, 3°55'S & 144°33'E, sea level, coastal woodland dominated by *Casuarina* trees, on dead wood, 17.5.1992, Van der Gucht K. & De Meester L. 92-1022 (culture) (GENT).

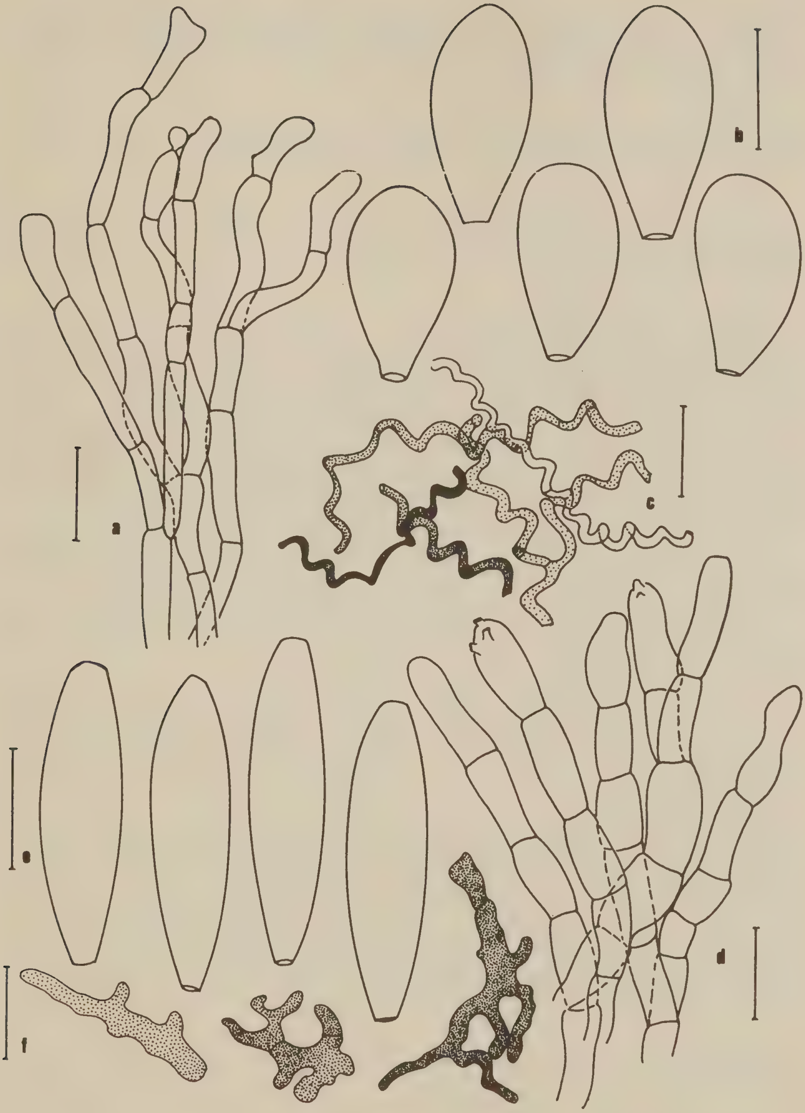


Plate 5: *Xylaria feejeensis* - ANAMORPH as formed in culture (92-1137): a. conidiophores (scale bar = 10 µm), b. conidia (scale bar = 5 µm), c. coiled hyphae of the mycelium (scale bar = 10 µm); *Xylaria grammica* - ANAMORPH as formed in culture (92-1371): d. conidiophores (scale bar = 10 µm), e. conidia (scale bar = 5 µm), f. brown hyphae with short protuberances as formed in aging colonies (scale bar = 10 µm).

MADANG PROVINCE: Balek Wildlife Sanctuary, 5°20'S & 145°43'E, elev. 150 m, lowland hill forest, on dead wood, 11.11.1989, Van der Gucht K. & De Meester L. 89-1815 (culture) (GENT). Awar, 4°6'S & 144°50'E, sea level, coastal woodland and remnant forest, on dead wood, 18.5.1992, Van der Gucht K. & De Meester L. 92-1069 (culture) (GENT).

The cultural and anamorphic characteristics of the Papua New Guinean material correspond completely with the above-mentioned description.

Xylaria grammica (Mont.) Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1: 128 (1851). - Pl. 5d-f, Pl. 10d.

CULTURAL CHARACTERISTICS

COLONIES reaching edge of Petri dish in 2-3 weeks, at first white, with plumose margins, velvety, becoming light yellow to orange-white (5)(A)(2), sometimes with a greenish tint (3)(B)(2), finally darkening from centre outwards (5)(E)(2-3), the centre covered with white cottony mycelium. Reverse brownish orange, yellowish brown, golden brown to light brown (5-6)(C-D-E)(5-8). Exudate colourless to orange. HYPHAE parallel, sparingly branched, septate, becoming dark brown, densely septate, more irregularly branched, and finally breaking down into segments. STROMATA formed after 3-4 weeks, in a more or less concentric zone around the centre of the colony, at first yellowish, later darkening from base upwards, greyish to dark olive-green, apices remaining white, cylindrical, up to 5 cm total height x 3 mm diam. CONIDIOGENOUS STRUCTURES formed either on subglobose wart-like structures developed on the cylindrical stromata or on small dense clusters of conidiophores directly on the mycelium.

- Conidiogenous structures in dense clusters directly on the mycelium: CONIDIOPHORES irregularly branched, hyaline, smooth, 2.5-3.5 μm diam. CONIDIOGENOUS CELLS terminal, cylindrical or more irregularly shaped, swollen, hyaline, smooth, 12-32 μm x 4-6 μm, bearing circular refractile conidial scars apically and laterally.
- Conidiogenous structures on subglobose wart-like structures:

CONIDIOPHORES in palisades, not branched or branched dichotomously, hyaline, smooth, 4-5.5 μm diam. CONIDIOGENOUS CELLS terminal, cylindrical, hyaline, smooth, 12-15 x 3.5-5 μm, bearing denticulate conidial scars apically.

No apparent morphological difference between the conidia from either location.

CONIDIA acropleurogenous, elongated ellipsoid with a flattened circular abscission scar at the base, and a broad flattened apex, hyaline, smooth, 12-14(15.5) x 3-3.5(4) μm (avg. ± SD: 13.15 ± 0.88 x 3.30 ± 0.27 μm).

For description of corresponding teleomorph see Van der Gucht (1995).

OTHER DESCRIPTION AND ILLUSTRATIONS: Rogers et al. 1987: 161, figs. 41-43 (anamorph in culture).

SPECIMENS EXAMINED AND CULTURED: MADANG PROVINCE: Ramu Region, Paiya, 5°47'S & 145°22'E, elev. 150-200 m, rain forest on hill, on dead wood near stream, 26.5.1992, Van der Gucht K. & De Meester L. 92-1357 (culture) & 92-1371 (culture) (GENT).

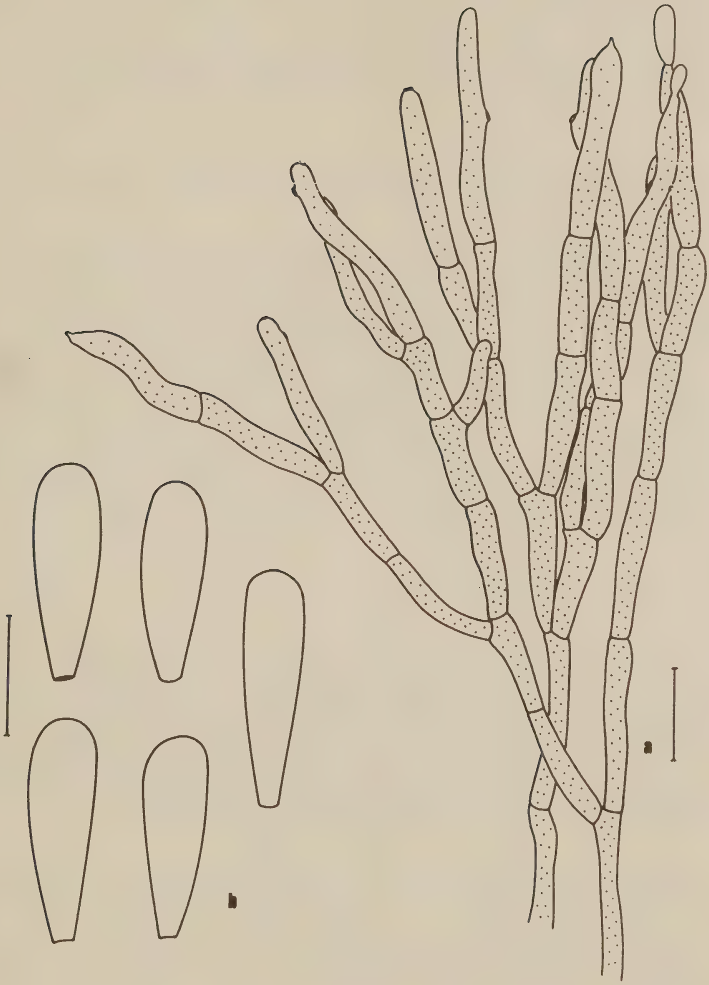


Plate 6: *Xylaria frustulosa* - ANAMORPH as formed in culture (89-1815): a. conidiophores (scale bar = 10 µm), b. conidia (scale bar = 5 µm).

The cultural and anamorphic characteristics correspond largely to the ones described by Rogers et al. (1987), except for the size of the conidia which were smaller [12-14(15.5) x 3-3.5(4) µm versus (16)17-21 x (3)4-5 µm], and the development of long cylindrical stromata bearing fertile subglobose wart-like structures. This might indicate geographic variations among collections identified as *X. grammica*.

Xylaria laevis Lloyd, *Xylaria* Notes 1, Mycol. Writings 5: 8 (1918). - Pl. 4g-h.

CULTURAL CHARACTERISTICS

COLONIES reaching edge of a 9 cm diam. Petri dish in 10 days, at first white, with plumose margins, velvety, often with faint concentric zones and radiating ridges, greyish orange (6)(A-B)(2-3) from centre outwards, becoming overlain with a very thick layer (often reaching the lid of the Petri dish) of coarse lanose mycelium, the surface of which finally becomes flocculose and lighter in patches. Reverse pale orange to orange (5)(A)(3-5). Exudate yellowish orange. HYPHAE parallel, sparingly branched, septate, hyaline and smooth. Clusters of brown, swollen, thick walled cells, remaining in chains, are formed in aging colonies. STROMATA formed after 20 days throughout the whole colony, most numerous at the centre, robust, branched, at first white to orange-white (6)(A)(2), becoming covered from the base upward with dense brownish villose hyphae. The colonies remained sterile.

For description of corresponding teleomorph see Van der Gucht (1995).

SPECIMENS EXAMINED AND CULTURED: MADANG PROVINCE: Amron village, 5°7'S & 145°45'E, elev. 40 m, lowland hill forest with some garden regrowth, on dead decorticated wood, 3.5.1992, Van der Gucht K. & De Meester L. 92-519 (culture) (GENT). Hansa Bay, Laing Island, coralligenous island 700 x 100 m, 4°10'S & 144°52'E, sea level, S.W. side of island, on dead decorticated wood, 9.5.1992, Van der Gucht K. 92-821 (culture) (GENT). Awar, 4°6'S & 144°50'E, sea level, rain forest located near the sea, on dead decorticated wood, 20.5.1992, Van der Gucht K. & De Meester L. 92-1122 (culture) & 92-1153 (culture) (GENT). Ramu region, road to Bundi, 5°44'S & 145°19'E, alluvial flood-plain forest, on dead wood, 27.5.1992, Vyverman W. & Vyverman R. 92-1436 (culture) (GENT). Balek Wildlife Sanctuary, 5°19'S & 145°43'E, elev. 50m, lowland rain forest, on dead wood, 29.5.1992, Van der Gucht K. & De Meester L. 92-1473 (culture) (GENT).

This taxon is closely allied to and has been confused with *Xylaria cubensis* (Van der Gucht 1995). It differs in cultural characteristics by colonies covered by a very thick layer (often reaching the lid of the Petri dish) of coarse lanose mycelium (colonies from *X. cubensis* are not covered by a very thick layer of coarse lanose mycelium) and the colonies remained sterile (in cultures of *X. cubensis* the anamorph is produced on cylindrical to flabelliform stromata or on tufts on the mycelium). See also remarks under *X. cubensis*.

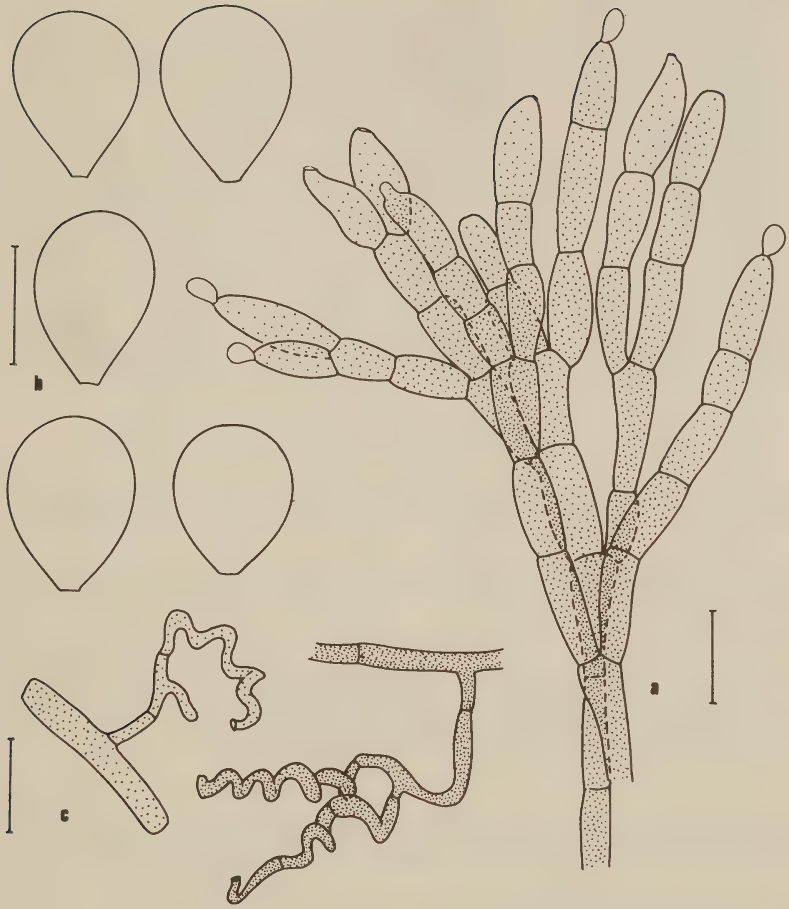


Plate 7: *Xylaria luteostromata* - ANAMORPH as formed in culture (92-1300): a. conidiophores (scale bar = 10 µm), b. conidia (scale bar = 5 µm), c. coiled hyphae of the mycelium (scale bar = 10 µm).

Xylaria luteostromata Lloyd, Large Pyrenomycetes 2, Mycol. Writings 5: 31 (1919) [as *X. luteostroma*]. Pl. 7a-c.

CULTURAL CHARACTERISTICS

COLONIES on oatmeal agar at ca. 20°C, under 12 h light and 12 h darkness, reaching edge of a 9 cm diam. Petri dish in 2 weeks, at first white, very thin with fine texture, centre becoming faint orange, later with yellow (3)(A)(4), orange-grey (6)(B)(2), olive-grey (3)(D)(3) to brownish grey (4)(C-D)(2) areas, and becoming furrowed with radiating depressions, the centre finally becoming overlain with white floccose mycelium. Reverse orange in the centre (5)(B)(5), brown towards the margins (5)(E)(4). Exudate colourless. HYPHAE sparingly branched, septate, highly coiled or straight, at first hyaline, later becoming brown, ± 2 µm diam. STROMATA developing in the centre of aging colonies, small, rudimentary. Conidium-bearing regions developing on the rudimentary stromata. CONIDIOPHORES in palisades, dichotomously branched, brown, smooth, up to 75 µm long x 4 µm diam. CONIDIOGENOUS CELLS terminal, cylindrical, subhyaline to light brown, smooth, 12-20 x 2.5-3 µm, bearing circular refractile conidial scars apically and laterally. CONIDIA acropleurogenous, subglobose, with a flattened circular abscission scar at the base, hyaline, smooth, 5.5-7 x 5-5.5 µm (avg. ± SD: 6.40 ± 0.80 x 5.08 ± 0.39).

For description of corresponding teleomorph see Van der Gucht (1995).

OTHER DESCRIPTIONS AND ILLUSTRATIONS: Martin 1970: 112-113 (cultural characteristics); Rogers et al. 1987: 163-164, fig. 21 (cultural characteristics).

SPECIMEN EXAMINED AND CULTURED: MADANG PROVINCE: Ramu Region, 5°47'S & 145°23'E, elev. 150 m, alluvial flood-plain forest, on dead wood, 26.5.1992, Van der Gucht K. & De Meester L. 92-1300 (culture) (GENT).

Rogers et al. (1987) mentioned that this species is certainly allied to *X. castorea* Berk. and *X. feejeensis* (Berk.) Fr. The cultural and anamorphic features, indeed, reinforce the concept of a relationship with *X. feejeensis* (e.g. general appearance, texture of the colony surface, presence of coiled hyphae).

Xylaria multiplex (Kunze) Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1: 127 (1851) sensu Dennis, Kew Bull. 11 (1956): 416 (1957). - Pl. 9d-f, Pl. 10h.

CULTURAL CHARACTERISTICS

COLONIES reaching edge of Petri dish in 2 weeks, at first white, velvety with distinct plumose margins, later darkening to greenish grey (28)(E)(2) or dull black from centre outwards, finally in the centre becoming overlain by thin white aerial mycelium. Reverse olive-grey (3)(E)(2) in the centre, brownish orange (6)(C)(4) towards the margins. HYPHAE sparingly branched, septate, hyaline, smooth, ± 2 µm diam., becoming dark brown, densely septate, more irregularly shaped, branched and finally breaking down into segments. STROMATA produced within 3 weeks, cylindrical, up to 1 cm long x 1 mm diam., covered from base upwards with villose

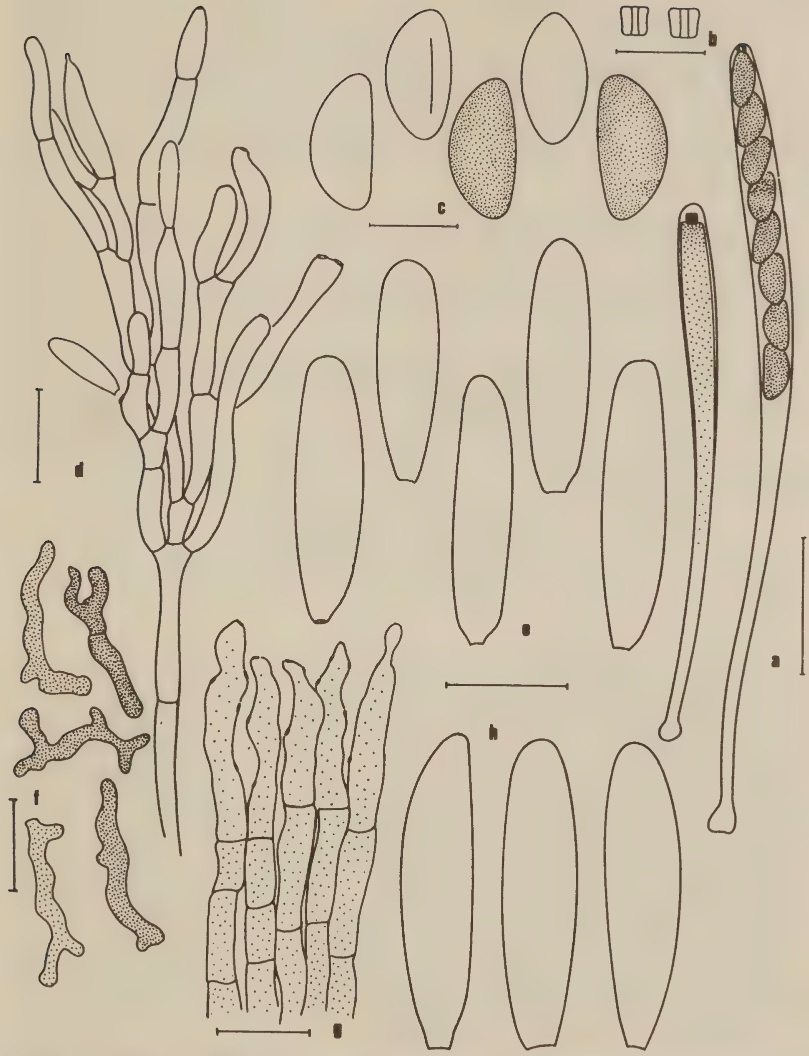


Plate 8: *Xylaria* cf. *pallida* - TELEOMORPH (92-1559): a. asci (scale bar = 20 µm), b. apical apparatus (scale bar = 5 µm), c. ascospores (scale bar = 5 µm); ANAMORPH as formed in culture (92-1559): d. conidiophores (scale bar = 10 µm), e. conidia (scale bar = 5 µm), f. brown hyphae with short protuberances as formed in aging colonies (scale bar = 10 µm); ANAMORPH as found in nature (89-1045): g. conidiophores (scale bar = 10 µm), h. conidia (scale bar = 5 µm).

black hyphae, remaining white at the top. Stromata remaining sterile. CONIDIOGENOUS STRUCTURES formed on small white tufts, 3-4 mm diam., developing within 4 weeks. CONIDIOPHORES in palisades, sparingly branched, hyaline, smooth, 2.5-3 µm diam CONIDIOGENOUS CELLS terminal, cylindrical, hyaline, smooth, 12 x 2.5 µm, bearing circular refractile conidial scars apically and laterally. CONIDIA acropleurogenous, elongated ellipsoid with a small flattened circular abscission scar at the base, and a broadly rounded to flattened apex, hyaline, smooth, 17.5-18.5 x 2.2-2.5 µm.

For description of corresponding teleomorph see Van der Gucht (1995).

OTHER DESCRIPTIONS AND ILLUSTRATIONS: Martin 1970: 119, pl. IV:6, VI:6 (cultural characteristics); Rodrigues et al. 1993: 127 (cultural characteristics).

SPECIMEN EXAMINED AND CULTURED: MADANG PROVINCE: Ramu Region, 5°47'S & 145°23'E, well drained alluvial forest, on dead wood, 26.5.1992, Van der Gucht K. & De Meester L. 92-1370 (culture) (GENT).

Based on its cultural and anamorphic characteristics *X. multiplex* seems closely related to *X. grammica*.

Xylaria* cf. *pallida Berk. & Cooke, J. Linn. Soc., Bot. 15: 395 (1876). - Pl. 8a-h, Pl. 10e-g.

TELEOMORPH

STROMATA gregarious, unbranched, cylindrical to clavate with rounded fertile apices, on well-defined, rather long, slender, smooth stipes (6-20 mm high x 1-1.5 mm diam.), 2-4 cm total height x 0.3-0.4 cm diam. Externally at first white (immature stromata), becoming silvery greyish brown (7)(F)(3) to finally dull black with age. Internally white, becoming hollow with age. Texture hard. Surface smooth, with older stromata dotted with white to beige granular material. PERITHECIA completely immersed, subglobose, 0.4-0.6 mm diam.; ostioles inconspicuous to slightly raised, umbilicate. PARAPHYSES filiform, tapering towards the apex, vaguely septate, ± 2 µm diam. near the top. ASCI cylindrical, 8-spored, long stalked, 110-120 x 5.5-6 µm (spore bearing part 45-55 µm long); apical apparatus cubic to rectangular, 1.6-1.8 µm high x 1.6-1.8 µm broad, blueing in Melzer's iodine reagent. ASCOSPORES uniseriate to obliquely uniseriate, inaequilaterally ellipsoid, with broadly rounded ends, light to medium brown, smooth, 7-8.5(9) x 3-4(4.5) µm; germ slit inconspicuous, straight, on the ventral side of the spore, almost full spore length.

CULTURAL CHARACTERISTICS

COLONIES reaching 7 cm diam. in 3-4 weeks, at first thin, hyaline, appressed, later the centre becoming orange-white (7)(A)(2) and furrowed, finally with sectors turning greyish red (8)(B)(5) to dark grey to almost black (8)(E)(1) with an overall woolly to floccose aspect; margin not distinct. Exudate colourless to light yellow to orange. Reverse greyish red (7)(B)(3) in the centre, grey (7)(C)(1) towards the margins.

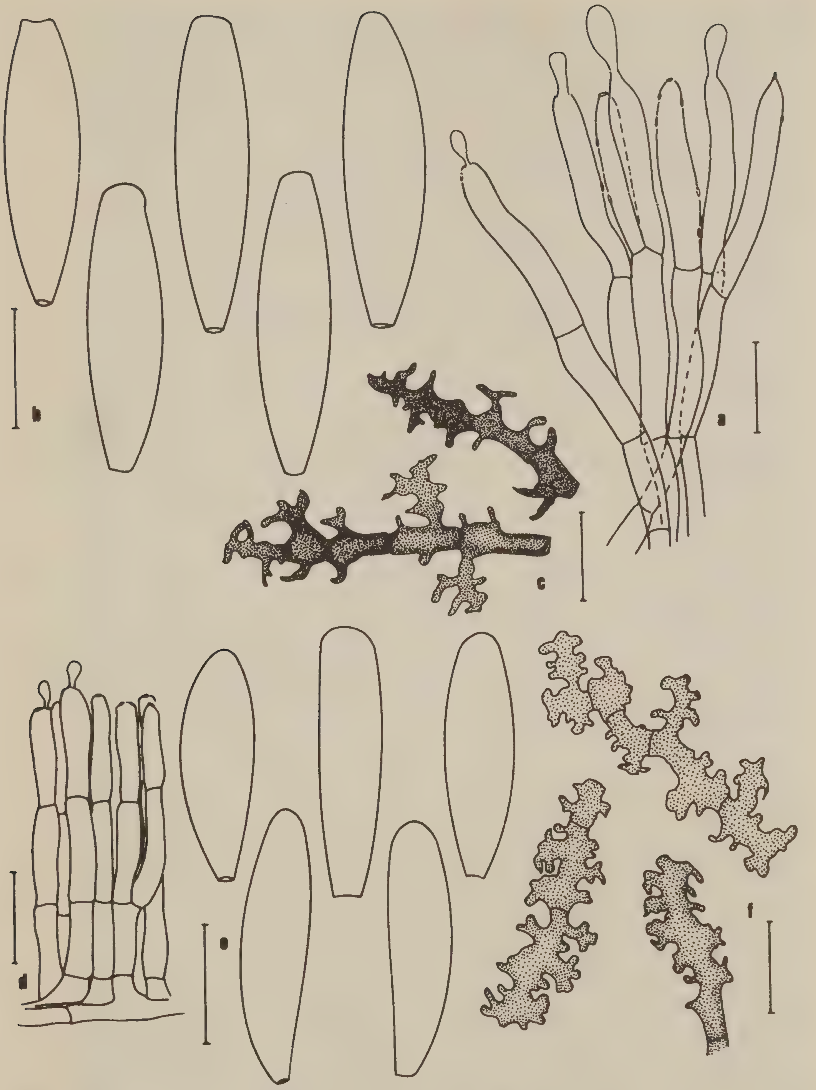


Plate 9: *Xylaria papulis* - ANAMORPH as formed in culture (92-625): a. conidiophores (scale bar = 10 µm), b. conidia (scale bar = 5 µm), c. brown hyphae with short protuberances as formed in aging colonies (scale bar = 10 µm); *Xylaria multiplex* - ANAMORPH as formed in culture (92- 1370): d. conidiophores (scale bar = 10 µm), e. conidia (scale bar = 5 µm), f. brown hyphae with short protuberances as formed in aging colonies (scale bar = 10 µm).

HYPHAE sparingly branched, septate, hyaline, smooth, ± 2 mm diam. STROMATA formed after 3 weeks in a concentric zone near the centre, cylindrical, at first white to orange-white, turning grey from base upward, up to 1.5 cm high x 1-3 mm diam. The stromata remained sterile. Conidiogenous structures formed after 1 month on small, reddish grey (7)(B)(2) tufts. CONIDIOPHORES in loose palisades, di- to trichotomously branched, hyaline, smooth, up to 90 µm long x 2-2.5 µm diam. CONIDIOGENOUS CELLS terminal or intercalary, cylindrical, hyaline, smooth, 12-20 x 2.5-3 µm, bearing the conidial scars apically or laterally. CONIDIA acropleurogenous, elongated ellipsoid, with a flattened circular abscission scar at the base, hyaline, smooth, 9-12 x 2.5-3 µm.

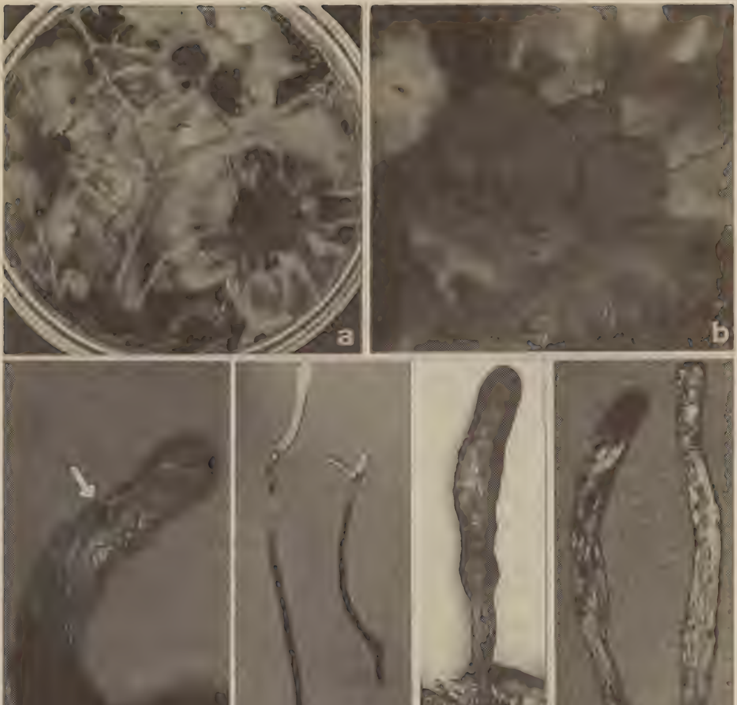
ANAMORPH AS FOUND IN NATURE

Anamorph formed as subglobose or wart-like structures present on immature white teleomorphic stromata, up to 1-2 x 1-5 mm. Conidium-bearing regions covering the entire surface of the warts, grey (4)(B)(1). CONIDIOPHORES in palisades, unbranched or branched near the base, subhyaline, smooth, 2.5-3 µm. CONIDIOGENOUS CELLS terminal, cylindrical, subhyaline, smooth, 16-25(27) x 3-4 µm, bearing circular refractile conidial scars apically and laterally. CONIDIA acropleurogenous, elongated ellipsoid, with a flattened abscission scar at the base, hyaline, smooth, 11-13(14.5) x 3-3.5 µm.

SPECIMENS EXAMINED AND CULTURED: MADANG PROVINCE: Finisterre Range, near Naru River ford road Madang-Lae, 5°24'S & 145°38'E, elev. 200 m, rain forest, on dead wood, 11.11.1989, Van der Gucht K. & De Meester L. 89-1783 (GENT). Baiteta, 5°0'S & 145°44'E, elev. 50 m, rain forest, on dead decorticated wood, 2.6.1992, Van der Gucht K. & De Meester L. 92-1559 (culture) (GENT). Ramu region, Paiya, 5°46'S & 145°22'E, alluvial rain forest, Vyverman W. & R. 92-1382 (culture) (GENT). MOROBE PROVINCE: Lae, direction Gawan, 4 km beyond the bridge over the Busu River, 6°37'S & 147°02'E, elev. 300 m, rain forest, on dead wood, 23.10.1989, Van der Gucht K. 89-1040 & 89-1045 (including the anamorphic state) (GENT).

Since the teleomorph of the material brought in culture was not described before, I here include a description. The material studied corresponds well to the description and illustration of *Xylaria pallida* given by Gonzalez & Rogers (1989: 355, fig. 72), except that the ascospores measure slightly smaller: 7-8.5(9) x 3-4(4.5) µm vs (8.5)9-10(11) x 3.5-4.5 µm. Because of this slight difference, and because I have not been able yet to study the type material, I prefer to call this fungus *X.* cf. *pallida*.

Plate 10: *Xylaria papulis* - ANAMORPH as formed in culture (92-625): a. culture (9 cm diam. Petri dish), b. conidiomata (x 3.5) - ANAMORPH as found in nature (89-992): c. habitus (anamorph formed on wart-like structures developed on immature teleomorphic stromata) (x 0.7); *Xylaria grammica* - ANAMORPH as formed in culture (92-1371): d. stromata (x 1); *Xylaria* cf. *pallida* - TELEOMORPH (92-1559): e. habitus (x 2) - ANAMORPH as found in nature (89-1045): f. habitus (anamorph formed on wart-like structures developed on immature teleomorphic stromata) (x 1.5) - ANAMORPH as formed in culture (92-1559): g. culture (9 cm diam. Petri dish); *Xylaria multiplex* - ANAMORPH as formed in culture (92- 1370): h. culture (9 cm diam. Petri dish).


a
b
c
d
e
f
h
g

Based on its anamorphic characteristics here described for the first time, this fungus seems to be closely related to *X. grammica*, *X. multiplex* and *X. papulis* (see further).

Xylaria papulis Lloyd, Mycol. Writings 6: 1055 (1921). - Pl. 9a-c, Pl. 10a-c.

CULTURAL CHARACTERISTICS

COLONIES reaching edge of Petri dish in 2 weeks; at first white, velvety, with faint concentric zones, becoming canary-yellow to greenish yellow to dark olive-green (1-2)(E-F)(7-8), finally darkening from centre outwards, olive-black, the centre covered with white cottony mycelium. Reverse ochre-yellow (3-4)(A-B)(3-5) to deep wine-red, greenish at the centre. Exudate greenish yellow. HYPHAE parallel, sparingly branched, septate, hyaline, smooth, ± 2 µm diam., becoming dark brown, closely septate, irregularly branched, and finally breaking into segments. STROMATA formed after 3 weeks in the centre of the colony, subglobose, moriform to cauliflower-shaped, up to 0.7 x 0.7 cm, olive-brown (5-6)(B-D)(4), villose when young, turning olive-grey (5-6-7)(D)(3) due to conidial production. Conidium-bearing regions covering the entire surface of stromata. CONIDIOPHORES in palisades, sparingly branched, hyaline, smooth, 2.5-3.5 µm diam. CONIDIOGENOUS CELLS terminal, cylindrical, hyaline, smooth, 16-24 x 3-4 µm, bearing circular refractile conidial scars apically and laterally. CONIDIA acropleurogenous, elongated ellipsoid with a flattened circular abscission scar at the base, and a broad flattened apex which sometimes appears to be fringed, hyaline, smooth, 11-13 x (2.5)3-3.5 µm.
In one of the cultures (92-625) cylindrical stromata were formed after six weeks, pale pink when young (with an orange exudate), becoming canary-yellow, green and finally black from base upwards, villose. No conidiogenous structures observed on the cylindrical stromata.

ANAMORPH AS FOUND IN NATURE

Anamorph formed on subglobose wart-like structures, grey (4)(C)(1), 2-3 mm diam., developed on immature teleomorphic stromata. Conidium-bearing regions covering the whole surface of the warts. CONIDIOPHORES in palisades, unbranched or branched near the base, subhyaline, smooth, 3-4 µm diam. CONIDIOGENOUS CELLS terminal, cylindrical, subhyaline, smooth, 16-20 x 3-4 µm, bearing in the upper part small circular refractile conidial scars. CONIDIA acropleurogenous, elongated ellipsoid, with a flattened abscission scar at the base and a broadly flattened apex, hyaline, smooth, (9.5)10-12(13) x (2)2.5-3 µm (avg. ± SD: 11.12 ± 0.91 x 2.56 ± 0.32 µm).

For description of corresponding teleomorph see Van der Gucht (1995).

SPECIMENS EXAMINED AND CULTURED: MADANG PROVINCE: Finisterre Range, near the Naru River ford on road Madang-Lae, 5°24'S & 145°38'E, elev. 200 m, rain forest, on dead wood, 22.10.1989, Van der Gucht K. 89-992 (including the anamorphic state) (GENT). Balek Wildlife Sanctuary, 5°19'S & 145°43'E, elev. 50 m, rain forest, on dead wood, 4.5.1992, Van der Gucht K. & De Meester L. 92-625 (culture) (GENT). Ramu Region, 5°46'S & 145°22'E, elev. 150 m, alluvial flood-plain forest, on dead wood, 26.5.1992, Vyverman W. & Vyverman R. 92-1338 (culture) (GENT).

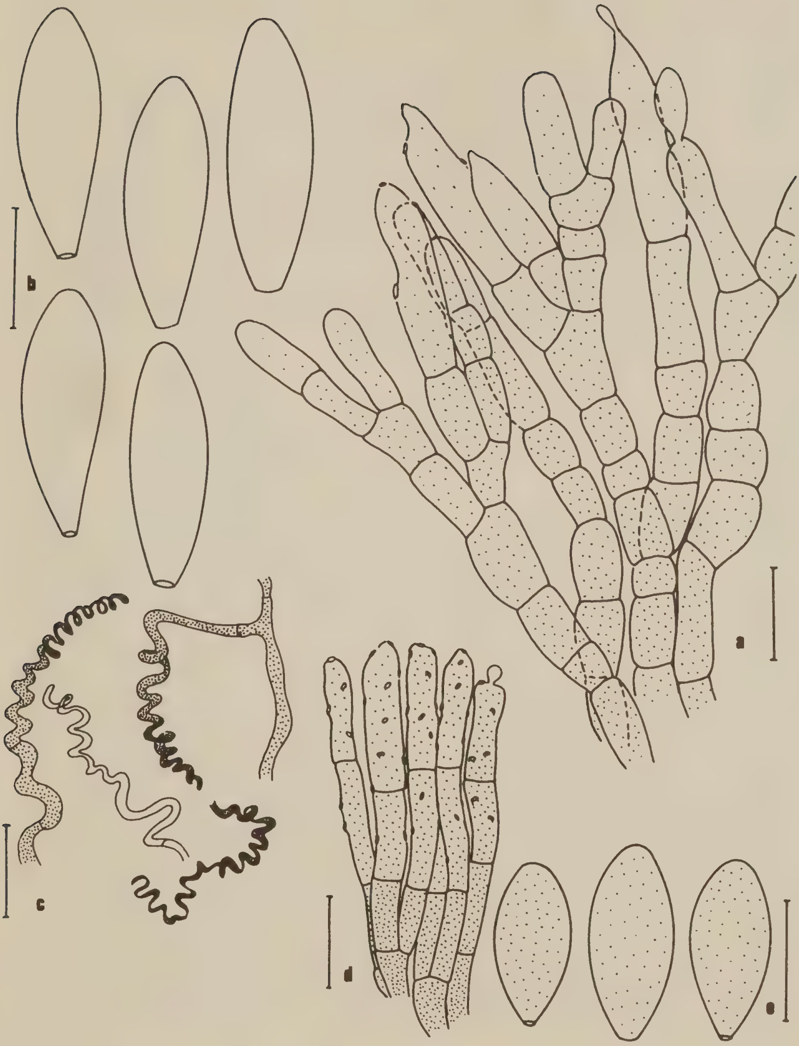


Plate 11: *Xylaria schweinitzii* - ANAMORPH as formed in culture (92-1343): a. conidiophores (scale bar = 10 µm), b. conidia (scale bar = 5 µm), c. coiled hyphae as found in the mycelium (scale bar = 10 µm); ANAMORPH as found in nature (92-1597): d. conidiophores (scale bar = 10 µm), e. conidia (scale bar = 5 µm).

The production of an olive-green pigment in culture is very characteristic for this taxon. The same obervation was made by Yu-M. Ju and J.D. Rogers culturing material from Taiwan (J.D. Rogers & Yu-M. Ju, personal communication). In general cultural characteristics, as well as in the general conidial shape, the material shows similarities with the anamorph of *X. grammica*, *X. multiplex* and *X.* cf. *pallida*. These taxa represent a conspicuous group of species characterised by a bright colouration of the colonies as well as of the immature stromata, the production of conidia on wart-like structures, and the shape of the conidia. Rogers (1985) who, based upon anamorphic characteristics, proposed a subdivision of the genus *Xylaria* into 8 groups divided upon 4 sections did not recognise this group. He recognized a *X. multiplex* group with the following members: *X. apiculata* Cooke, *X. arbuscula* Sacc., *X. multiplex* (Kunze) Fr. and *X. schreuderiana* van der Bijl. According to my observations, however, *X. multiplex* is more closely related to *X. grammica*, *X. papulis* and *X.* cf. *pallida* than to *X. arbuscula* and *X. apiculata* (Van der Gucht, in press).

Xylaria poitei (Lév.) Fr., Nova Acta Regiae Soc. Sci. Upsal. (ser. 3) 1: 125 (1851). Pl. 2d-f, Pl. 3d-e.

CULTURAL CHARACTERISTICS

COLONIES reaching edge of Petri dish in 3-4 weeks, at first white to orange-white (5)(A)(2), with plumose margins, woolly, later blackening from centre outwards. Reverse brown (5)(E)(5). Exudate bright red, orange to yellow. HYPHAE parallel, sparingly branched, septate, hyaline, smooth, 2-2.5 µm diam. CONIDIOGENOUS STRUCTURES formed after 4-5 weeks either on cylindrical to clavate stromata in the centre of the colony or on minute subglobose stromata at the colony margin. Cylindrical to clavate stromata, unbranched or branched, at first orange-white, later the central part grey (5)(B)(1) due to conidial production, up to 1 cm high x 0.4 cm diam., with an orange-white apex remaining sterile and proliferating. Minute, subglobose stromata, often laterally flattened, and joined together with neighbouring stromata, at first orange-white, later becoming grey due to conidia production. Conidia-bearing regions covering the entire surface of the minute stromata. No apparent morphological difference between conidiogenous structures from either location. CONIDIOPHORES in palisades, repeatedly branched, hyaline, smooth, 3-4 µm diam. CONIDIOGENOUS CELLS terminal, cylindrical, hyaline, smooth, 24-28 x 3-4 µm, bearing in the upper part circular refractile conidial scars. CONIDIA acropleurogenous, obovoid, with a concave or truncate apex (which seems to be an apical corone by S.E.M., fide Rogers & Callan 1986a), and a flattened circular abscission scar at the base, hyaline, smooth, 6-8 x 2.5-35 µm.

For description of corresponding teleomorph see Van der Gucht (1995).

OTHER DESCRIPTION AND ILLUSTRATIONS: Rogers & Callan 1986a: 287-296, figs. 1-19 (anamorph in culture and nature).

SPECIMENS EXAMINED AND CULTURED: EAST SEPIK PROVINCE: Watam, 4°58'S & 144°30'E, canoe

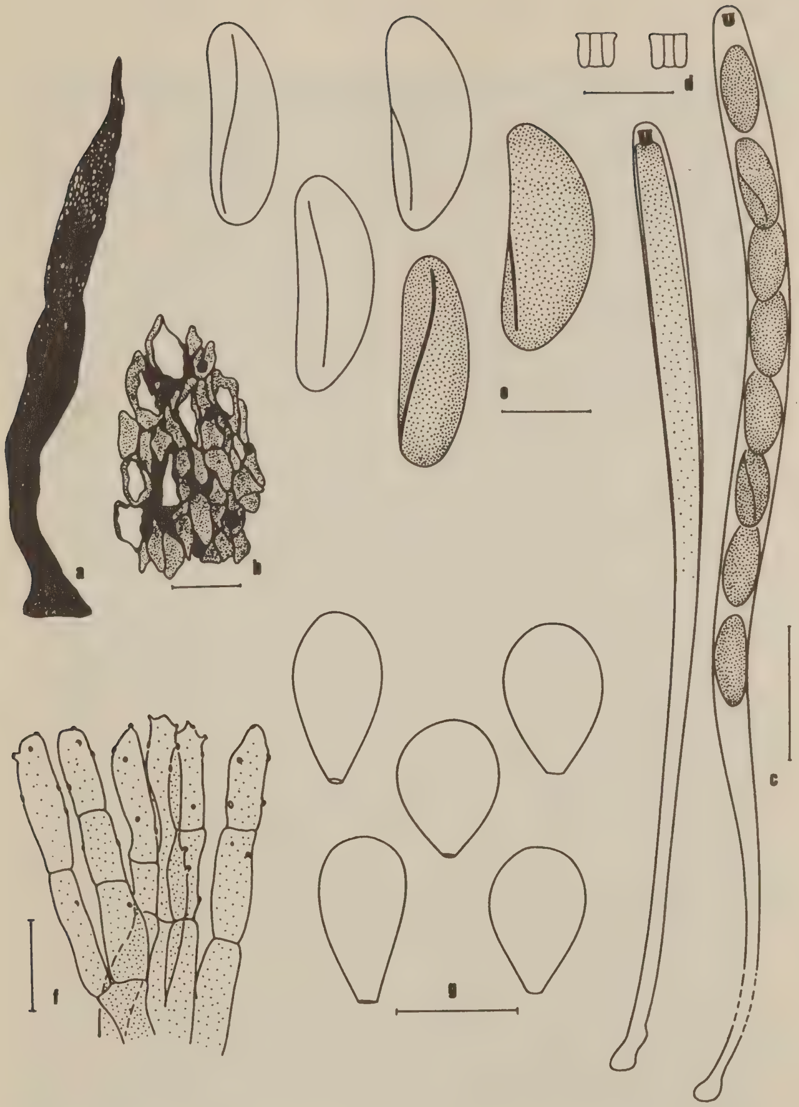


Plate 12: *Xylaria sp.*, aff. *arbuscula* - TELEOMORPH (92-1080): a. habitus (x 3), b. detail of the stromatal surface (scale bar = 0.5 mm), c. asci (scale bar = 20 µm), d. apical apparatus (scale bar = 5 µm), e. ascospores (scale bar = 5 µm); ANAMORPH as found in nature (92-1080): f. conidiophores (scale bar = 10 µm), g. conidia (scale bar = 5 µm).

passage to the Sepik River, mangrove woodland, on dead wood, 17.05.1992, Vyverman W. & Vyverman R. 92-997 (culture) & 92-998 (culture) (GENT).

The cultural and anamorphic characteristics corresponded closely with those described by Rogers & Callan (1986a), except that orange tones did not occur in their cultures.

Xylaria schweinitzii Berk. & M.A.Curtis, J. Acad. Nat. Sci. Philadelphia (ser. 2) 2: 284 (1853). - Pl. 11a-e, Pl. 13a-c.

CULTURAL CHARACTERISTICS

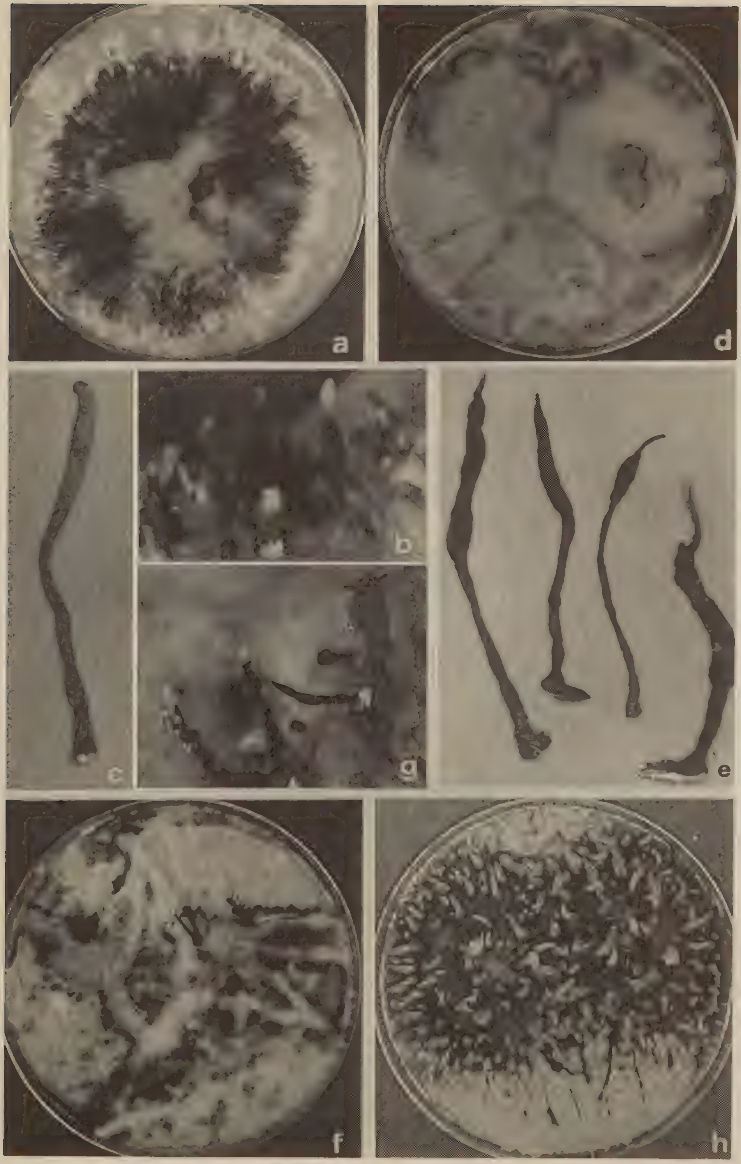
COLONIES reaching a diam of 5 cm in 6 weeks, appressed, at first white, with a plumose margin, faintly zonate, becoming floccose with a pinkish or reddish cast (5-6)(A)(2), finally darkening towards grey or black from centre outwards. Reverse brownish orange to tan (5)(C)(4). Exudate pinkish to colourless. HYPHAE parallel, sparingly branched, septate, straight or coiled, at first hyaline, later becoming brown, smooth. STROMATA formed after 6 weeks throughout the colony, cylindrical, 1-5 mm height x 1-1.5 mm diam, at first white to pink, becoming brownish orange, and finally grey due to conidial production. CONIDIOPHORES in palisades, sparingly branched, densely septate, subhyaline to brown, smooth, 4-5.5 µm diam. CONIDIOGENOUS CELLS terminal, cylindrical, hyaline to light brown, 12-22 x 4-5 µm, bearing circular refractile conidial scars apically and laterally. CONIDIA acropleurogenous, ellipsoid, with a flattened abscission scar at the base, hyaline, smooth, (8.5)9-11 x 3-3.5(4) µm. Most of the material brought in culture did not germinate.

ANAMORPH AS FOUND IN NATURE

Anamorph formed on cylindric-fusoid stromata, orange-grey (5)(B)(2), up to 2.5 cm length x 1-2 mm diam. Conidium-bearing regions on the upper part of the stromata. CONIDIOPHORES in palisades, unbranched or branched near the base, subhyaline, smooth, 3.5-4 µm. CONIDIOGENOUS CELLS terminal, cylindrical, subhyaline, smooth, 12-16 x 3-4 µm, apically and laterally densely covered with circular refractile conidial scars. CONIDIA acropleurogenous, ellipsoid, with a flattened circular abscission scar at the base, hyaline, smooth, 6.5-8(8.5) x 3-3.5 µm.

For description of corresponding teleomorph see Van der Gucht (1995).

Plate 13: *Xylaria schweinitzii* - ANAMORPH as formed in culture (92-1343): a. culture (9 cm diam. Petri dish), b. young stromata (x 5) - ANAMORPH as found in nature (92-1597): c. habitus (anamorph formed on cylindric stromata) (x 2); *Xylaria sp.*, aff. *arbuscula* - ANAMORPH as formed in culture (92-1073): d. culture (9 cm diam. Petri dish) - ANAMORPH as found in nature (92-1080): e. habitus (anamorph formed on the sterile apex of an immature teleomorphic stroma) (x 1); *Xylaria feejeensis* - ANAMORPH as formed in culture (92-1137): f. culture (9 cm diam. Petri dish), g. conidiomata (x 2); *Xylaria curta* - CULTURAL CHARACTERISTICS (92-1433a): h. culture (9 cm diam. Petri dish).


a
d
c
b
g
e
f
h

OTHER DESCRIPTIONS AND ILLUSTRATIONS: Rogers & Callan 1986b: 395-397, figs. 11-19 (anamorph in culture); Rogers et al. 1988: 142-143 (cultural characteristics).

SPECIMENS EXAMINED AND CULTURED: MADANG PROVINCE: Ramu Region, 5°47'S & 145°23'E, elev. 150 m, alluvial flood-plain forest, on dead wood, 26.5.1992, Vyverman W. & Vyverman R. 92-1343 (anamorphic state) (culture) (GENT). Baiteta, 5°0'S & 145°45'E, elev. 50 m, rain forest, on dead wood, 2.6.1992, Vyverman W. & Vyverman R. 92-1597 (anamorphic state) (GENT).

Cultural and anamorphic characteristics of the material collected in Papua New Guinea are very similar to those described by Rogers & Callan (1986b), except for the size of the conidia, the conidia of the specimens studied by me being somewhat larger: (8.5)9-11 x 3-3.5(4) µm vs (7)8-9 x 3-4(4.5) µm.
At least two earlier *Xylaria* binomials are conspecific with *X. schweinitzii* and much detailled work remains to be done in the *X. polymorpha* group (T. Læssøe, personal communication).

Xylaria* sp., aff. *arbuscula Sacc., Michelia 1: 249 (1878). - Pl. 12a-g, Pl. 13d-e, Pl. 14a-c.

TELEOMORPH

STROMATA gregarious, unbranched or branched near the base, cylindrical to spathulate, with an acute sterile apex (up to 0.5 cm), on a long narrow pubescent stipe (comprising 1/2 - 2/3 of the total height of the stromata x 1-2(3) mm in diam.), (2)3-6(7) cm total height x 2-5 mm diam. Externally dark brown (8)(F)(4) to black, initially covered by a white to grey peeling outer layer. Internally white, solid. Texture fairly hard. Surface cracked into longitudinally oriented minute scales, occasionally roughened by protruding perithecia. PERITHECIA partially to completely immersed, subglobose, 0.5-0.8 mm diam; ostioles conspicuous to inconspicuous, umbilicate, appearing as small hemispherical black discs. PARAPHYSES filiform, tapering towards the apex, remotely septate, ± 2 µm diam. near the top. ASCI cylindrical, 8-spored, long stalked, 150-180 x 6-7 µm (spore bearing part 80-90 µm long); apical apparatus cubic to rectangular, 2.5-3 µm high x 2-2.5 µm broad, blueing in Melzer's iodine reagent. ASCOSPORES uniseriate to obliquely uniseriate, inaequilaterally ellipsoid, with broadly rounded ends, brown to dark brown, smooth, (11)11.5-13.5(14) x 4-5 µm; germ slit spiralling, slightly less than full spore length.

CULTURAL CHARACTERISTICS

COLONIES reaching edge of Petri dish in 4 weeks, at first very thin, bright yellow at the centre (3)(A)(4) with white plumose margins, becoming thick, velvety to floccose, often concentrically zonate, orange-white (5)(A)(2) to tan to dark olive-brown (4)(F)(3) towards the centre. Reverse light yellow (4)(A)(4) to brownish yellow (5)(C)(5). HYPHAE sparingly branched, septate, hyaline, smooth, ± 2 µm diam. In aging colonies clusters of brown, thick walled, subglobose cells are formed. CONIDIOGENOUS STRUCTURES formed either on small tufts in regular, more or less concentric zones near the centre of the colony, or directly on the mycelium. Tufts at first orange-white, later becoming olive-grey (2)(D)(2) due to conidial production. No apparent

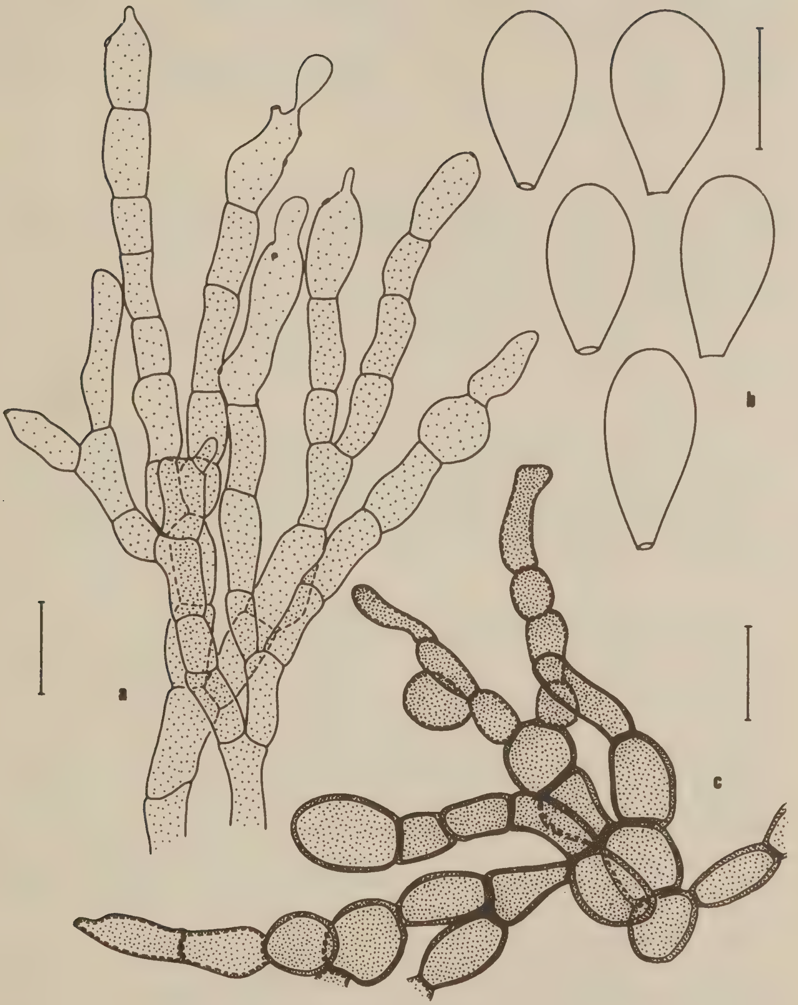


Plate 14: *Xylaria sp.*, aff. *arbuscula* - ANAMORPH as formed in culture (92-1073): a. conidiophores (scale bar = 10 µm), b. conidia (scale bar = 5 µm), c. clusters of brown, thick walled, subglobose cells (scale bar = 10 µm).

morphological difference between conidiogenous structures from either location (mycelium, tufts). CONIDIOPHORES irregularly branched, subhyaline, smooth, 3-4.5 µm diam. CONIDIOGENOUS CELLS terminal, cylindrical or more irregular in shape, hyaline, smooth, 10-16 x 3.5-4.5 µm, bearing conidial scars in the upper part. CONIDIA acropleurogenous, obovoid, with a flattened circular abscission scar at the base, hyaline, smooth, 6.5-8 x 3.5-4.5(5) µm.

ANAMORPH AS FOUND IN NATURE

Anamorph formed on the apex (up to 1 cm length x 0.65 mm diam.) of an immature teleomorphic stroma. Conidium-bearing regions over the whole surface of the apex, yellowish brown to grey-brown (6)(C)(2). CONIODIOPHORES in palisades, unbranched or branched near the base, light brown, smooth, 3.5-4 µm diam. CONIDIOGENOUS CELLS terminal, cylindrical, hyaline to light brown, smooth, 10-15 x 3-4 µm, densely covered with denticulate conidial scars. CONIDIA acropleurogenous, obovoid, with a flattened to concave circular abscission scar at the base, hyaline, smooth, (5.5)6-7(7.5) x 3.5-4.2 µm.

SPECIMENS EXAMINED AND CULTURED: MADANG PROVINCE: Awar, 4°6'S & 144°50'E, sea level, remnant forest (with many *Pandanus* sp.) at coast, on dead decorticated wood lying on the ground, 18.5.1992, Van der Gucht K. & De Meester L. 92-1061, 92-1066, 92-1073 (culture), 92-1080 (including the anamorphic state), 92-1090, 92-1092 & 92-1115 (GENT). Eo loco, 20.5.1992, Van der Gucht K.& De Meester L. 92-1159 (GENT). Ramu region, Paiya, 5°47'S & 145°23'E, rain forest on hill (open and dry), on dead decorticated wood, 26.5.1992, Van der Gucht K. & De Meester L. 92-1364 (culture) (GENT).

A similar fungus has been reported from Venezuela [Rogers et al. 1988: 118, sub '*X. arbuscula* (not typical)'] and Mexico (Gonzalez & Rogers 1989: 313-314, figs. 13, 14, sub *Xylaria* sp., aff. *arbuscula*). These and my records probably represent the same taxon, which is, according to the above mentioned authors, close to *X. arbuscula* (= *X. mellisii* (Berk.) Cooke). However, there are some differences in teleomorph (the smaller size of the ascospores and apical apparatus in the present taxon) as well as anamorph characteristics [entirely black and white colonies with no additional colours, black stromata with white apices, and smaller conidia (3)4.5-5(6) x 2-2.5(3) µm produced on the upper surfaces of the stromata or in loose tufts on the surface of the colony, for *X. arbuscula* (Martin 1970; Rogers et al. 1988; Callan & Rogers 1990) versus orange-white to tan colonies, and larger conidia produced on small tufts or in loose clusters on the surface of the colony for the species studied here].

X. arbuscula is considered to be a species complex which encompasses several taxa (e.g. Callan & Rogers 1990). Since this species complex is at present poorly understood, I consider it premature to erect a new taxon, even though the material studied represents a taxon clearly different from *X. arbuscula* s.s.

ACKNOWLEDGMENTS

I sincerely thank Prof. Dr. G. Hennebert for acquainting me with naming and interpreting anamorphic structures. Special thanks also to Prof. Dr. J.D. Rogers, Dr. Yu-M. Ju and Dr. T. Læssøe for sharing their expertise on problematic species and for reviewing the manuscript. I also thank R. Heynderickx for aid with photography.

Research was supported by grants n° 2.9006.86 and 2.9001.90 of the Belgian National Fund for Scientific Research.

LITERATURE CITED

Callan, B.E. & Rogers, J.D. 1990. Teleomorph-anamorph connections and correlations in some *Xylaria* species. Mycotaxon 36: 343-369.

Callan, B.E. & Rogers, J.D. 1993. A synoptic key to *Xylaria* species from continental United States and Canada based on cultural and anamorphic features. Mycotaxon 46: 141-154.

Gonzalez, F.S.M. & Rogers, J.D. 1989. A preliminary account of *Xylaria* of Mexico. Mycotaxon 34: 283-373.

Jong, S.C. & Rogers, J.D. 1970. *Penzigia frustulosa* in culture. Mycologia 62: 851-855.

Kendrick, B., Samuels, G.J., Webster, J. & Luttrell, E.S. 1979. Techniques for establishing connections between anamorph and teleomorph. In: Kendrick, B. (ed.), The whole fungus, the sexual-asexual synthesis. Vol. I & II. National Museums of Canada, Ottawa. 793 pp.

Kornerup, A. & Wanscher, J.H. 1978. Methuen Handbook of Colour. 3th edition. Eyre Methuen, London. 252 pp.

Læssøe, T. 1987. *Xylaria corniformis* reconsidered. Mycotaxon 30: 81-85.

Martin, P. 1970. Studies in the Xylariaceae: VIII. *Xylaria* and its allies. J. S. African Bot. 36: 73-138.

Rodrigues, K.F., Leuchtmann A., Petrini O. 1993. Endophytic species of *Xylaria*: cultural and isozymic studies. Sydowia 45: 116-138.

Rogers, J.D. 1983. *Xylaria bulbosa*, *Xylaria curta* and *Xylaria longipes* in continental United States. Mycologia 75: 457-467.

Rogers, J.D. 1984. *Xylaria cubensis* and its anamorph *Xylocoremium flabelliforme*, *Xylaria allantoidea*, and *Xylaria poitei* in continental United States. Mycologia 76: 912-923.

Rogers, J.D. 1985. Anamorphs of *Xylaria*: Taxonomic considerations. Sydowia 38: 255-262.

Rogers, J.D. & Callan, B.E. 1986a. *Xylaria poitei*: Stromata, cultural description, and structure of conidia and ascospores. Mycotaxon 26: 287-296.

Rogers, J.D. & Callan, B.E. 1986b. *Xylaria polymorpha* and its allies in continental United States. Mycologia 78: 391-400.

Rogers, J.D., Callan, B.E., Rossman, A.Y. & Samuels, G.J. 1988. *Xylaria* (Sphaeriales, Xylariaceae) from Cerro de la Neblina, Venezuela. Mycotaxon 31: 103-153.

Rogers, J.D., Callan, B.E. & Samuels, G.J. 1987. The Xylariaceae of the rain forests of North Sulawesi (Indonesia). Mycotaxon 29: 113-172.

Rogers, J.D. & Samuels, G.J. 1986. Ascomycetes of New Zealand. 8. *Xylaria*. New Zealand J. Bot. 24: 615-650.

Van der Gucht, K. 1995. Illustrations and descriptions of xylariaceous fungi collected in Papua New Guinea. Bull. Nat. Plantentuin Belg. 64: 219-403.

Van der Gucht, K. Anamorphs and the classification of *Xylaria* species. In: Proceedings of the symposium: "Fungal taxonomy and tropical mycology: quo vadis ?" - 29th June 1994 - Louvain-la-Neuve (in press).

MYCOTAXON

Volume LX, pp. 361-364 October-December 1996

A NEW SPECIES OF *HYGROCYBE* FROM INDIA

TK ABRAHAM, KB VRINDA AND CK PRADEEP

Tropical Botanic Garden and Research Institute, Palode,
Thiruvananthapuram - 695 562, Kerala, India

ABSTRACT

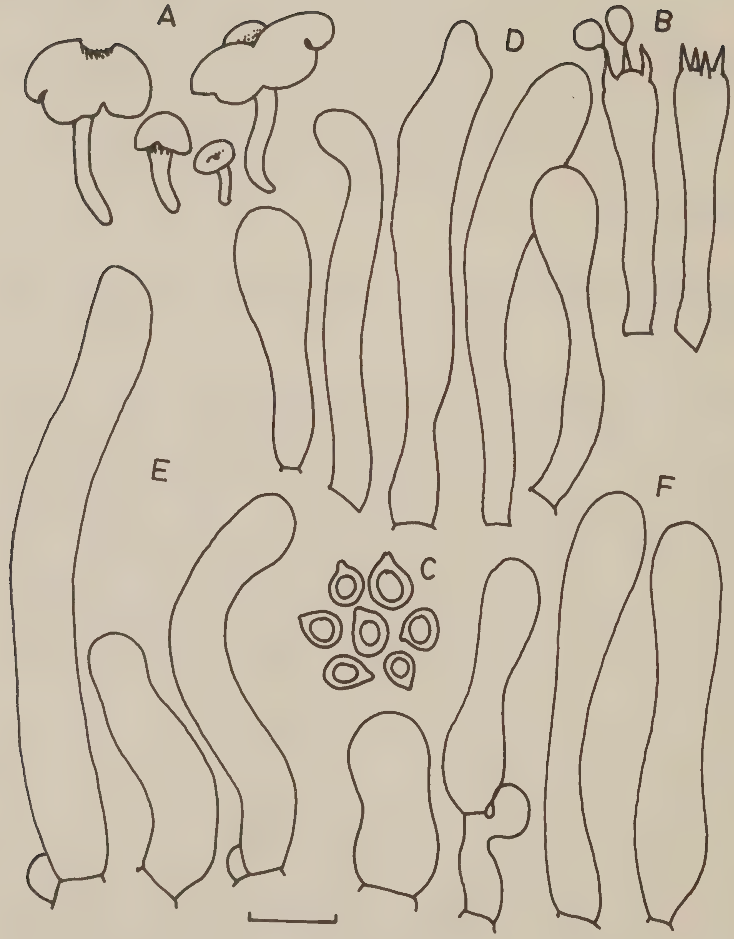
Hygrocybe parvispora sp. nov., is described from Kerala, south India.

During continuing and ongoing studies of the agaric flora of Western Ghats of Kerala, we collected an interesting species of *Hygrocybe* (Fr.) Kummer, that proved to be undescribed and is considered here as a distinct taxon. The morphological characteristics were drawn from fresh material. All sections were prepared in 3% KOH. Colour terminology used is that of Kornerup & Wanscher (1967). The specimens are deposited at the herbarium of the Microbiology division, TBGRI, Kerala and part at Kew.

Hygrocybe parvispora sp. nov. Fig. 1, A-F

Etymology: L. *parvispora*, small spored

Pileus 4-30 mm latus, convexo-depressus, aurantius, hygrophanus, glaber. Lamellae adnatae cum dente decurrente, aurantius, lamellulis intermixtae. Stipes 1.5-3 cm x 1-3 mm, centralis, cylindricus, aequalis, fistulosus, aurantius, glaber. Sporae (3) 4.5-6 x (2) 3-5.2 µm, subglobosae, hyalinae, inamyloideae. Basidia 34.5-40.5 x 4.5-9 µm, clavata, 4-


A
B
C
D
E
F

sporigera. Acies lamellarum sterilis. Cheilocystidia 14-55.5 x 4.5-12 µm, cylindro-clavata, hyalina. Pleurocystidia nulla. Trama hymenophoralis regularis, hyalina.

Pileus 4-30 mm diam., convex then plano-convex and slightly depressed at the centre; surface uniformly 'deep orange' (6A8/7A5/7A7/7A8/7C8), drying much paler (6A4/5A2/4A3), strongly hygrophanous, smooth and glabrous, not viscid, not translucent striate. Lamellae broadly adnate with a decurrent tooth, concolorous with the pileal surface, up to 3 mm broad, moderately close with lamellulae of different lenghts. Stipe 1.5-3 cm x 1-3 mm, central cylindric, equal, fistulose; surface concolorous with the pileus, yellowish towards the base, dry, smooth, glabrous. Context thin, up to 1 mm thick 'brownish orange' (6C8), becoming paler, composed of thin-walled, hyaline hyphae, 3-18 µm diam., with clamp-connexions. Spores (3) 4.5-6 x (2) 3-5.2 µm, subglobose, thin-walled, hyaline, with a distinct hilar appendage. Basidia 34.5-40.5 x 4.5-9 µm clavate, bearing four sterigmata (rarely one). Lamella-edge sterile, cheilocystidia abundant, hardly swelling after drying, measuring 14-55.5 x 4.5-12 µm, variously shaped, more often cylindro-clavate, thin-walled, hyaline. Pleurocystidia absent. Hymenophoral trama regular, hyaline, with parallel hyphae, 3-19.5 µm diam. Subhymenial layer interwoven. Pileipellis a cutis of semi-erect to erect hyphae, neither agglutinated nor gelatinized, with the terminal elements measuring 37-94.5 x 6-15 µm, with conspicuous clamp-connexions. Caulocystidia abundant on the upper part of the stipe, scattered and rare elsewhere, 37.5-51.5 x 10.5-18.5 µm cylindro-clavate, thin-walled, hyaline.

Scattered on soil.

Fig. 1, A-F *Hygrocybe parvispora*. A.habit x 1; B. basidia; C.spores; D.cheilocystidia; E.cuticular elements; F. caulocystidia Scale bar = 10 µm

Specimens examined: India, Kerala: **TBGRI campus**: 21 October 1993, No.73; 29 October 1993, No.142; 19 November 1993, No.403; 28 June 1994, No. 992; 30 June 1994, No. 1002; 15 July 1994, No.1070; 3 August 1994, No.1279; 6 August 1994, No. 1318; 9 August 1994, No.1335; 10 August 1994, No. 1342; 11 August 1994, No.1348; 2 September 1994, No.1476; 7 September 1994, No.1498; 25 October 1994 No.1818; 3 November 1994, No.1893; **Agasthyamala;** 2 August 1995, No.2406; **TBGRI campus**; 7 August 1995, No.2392; 8 August 1995, No.2402 (holotype); 18 November 1995, No. 2717, 21 November 1995, No.2762.

This small species of *Hygrocybe* is characterized with in the section *Coccineae* Fayod, by the convex-depressed orange pileus, lamellae and stipe, adnate to subdecurrent lamellae and lack of any gelatinization of either the pileal or stipe surfaces. It differs from all related species in the shape and much smaller size of the spores, sterile lamella-edge and presence of caulocystidia.

ACKNOWLEDGEMENTS

The authors are grateful to the WGDP of the Department of Planning and Economic Affairs, Government of Kerala for the financial assistance and to Dr.P.Pushpangadan, Director, TBGRI, for the encouragement and facilities for carrying out this work. Help rendered by Dr.D.N.Peglar, Royal Botanic Gardens, Kew England, in confirming the identity of the species and critically reviewing the manuscript is gratefully acknowledged. Thanks are also due to Dr.K.J.Joseph, Institute of European Languages, Thrissur, Kerala for the Latin diagnosis.

REFERENCE

Kornerup, A & Wanscher, J.H. 1967. *Methuen Handbook of Colour*. London: Methuen & Co. 243 pp.

MYCOTAXON

Volume LX, pp. 365-372 October-December 1996

NATS TRUFFLE AND TRUFFLE-LIKE FUNGI 5: *TUBER LYONII* (= *T. TEXENSE*), WITH A KEY TO THE SPINY-SPORED *TUBER* SPECIES GROUPS

JAMES M. TRAPPE, ARI M. JUMPPONEN AND EFRÉN CÁZARES

Department of Forest Science, Oregon State University,
Corvallis, OR 97331-7501

ABSTRACT

As a result of examination of the type of *Tuber lyonii* Butters and numerous collections of *Tuber texense* Heimsch, the latter is synonymized with the former. The species is redescribed to encompass its known phenotypic variation, and its range is extended from earlier reports in Texas, Georgia and Ohio to the presently known range of northeastern Mexico north to New Mexico, then east along the Gulf Coast to Florida and north to Minnesota, Québec, New York and Connecticut. The 3-layered wall of the asci of *T. lyonii* is described, and a key is provided to the three *Tuber* spp. that have spores ornamented with spines connected by a low reticulum.

INTRODUCTION

In recent years Mdme. Francisca Marzitelli of Ville d'Anjou, Québec sent us numerous collections of a *Tuber* sp. from the vicinity of Montreal that initially appeared to be an undescribed taxon related to *Tuber texense* Heimsch (1958). Examination of all collections of *T. texense* in our herbarium revealed, however, that the Québec collections fell within the range of variation of *T. texense* and represented a substantial northern and eastern extension of the range of that species. The range extension in turn prompted examination of other northern collections assigned by past workers to other taxa in the same species complex. This included an isotype of *T. lyonii* Butters (1903), a name synonymized with *T. rufum* Vitt. by Fischer (1938) and with *T. candidum* Harkn. by Gilkey (1939). *Tuber lyonii* not only differs from these two species in having reticulate spores but also proved to be conspecific with *T. texense.*

METHODS

Colors of fresh specimens are in general terms. Hand-cut sections of both fresh and dried material were mounted in water, 5% KOH, Melzer's reagent, or cotton blue for standard light microscopy. Measurements of structures are from mature specimens. Spores were measured in water mounts: other reagents may cause spores to either shrink or swell (N. S. Weber, personal communication). Other structures were measured in KOH mounts. Herbaria in which examined specimens are deposited are abbreviated according to Holmgren *et al.* (1990).

TAXONOMY

Tuber lyonii Butters, Bot. Gaz. 35: 431, 1903.
=*Tuber texense* Heimsch, Mycologia 50: 657, 1958.

Figure 1.

Ascomata hypogeous, subglobose to lobed, with shallow to deep furrows, 4-30 x 7-55 mm, yellowish brown to orange brown or dark reddish brown, often with dark brown patches, smooth, the furrows scabrous and white. **Gleba** gray in youth, becoming light brown as spores mature, marbled with narrow, white veins that tend to radiate from the base and emerge through the peridium in surface furrows. **Odor** pungent.

Peridium 300-500 µm thick. **Ectal excipulum (peridial epicutis)** 20-40 µm thick, of tightly interwoven, light yellowish brown hyphae 4-10 µm in diam at septa, the walls up to 2 µm thick, occasional to numerous cells inflated up to 6-10 (-15) µm in diam, often forming a narrow surface zone of pseudoparenchyma. **Ental excipulum (peridial subcutis)** of tightly interwoven, hyaline hyphae 2-5 µm in diam, the walls 2-3 µm thick.

Gleba of ascus-bearing veins *(venae internae)* of tightly interwoven, hyaline hyphae 2-5 µm in diam at septa, occasional cells inflated up to 15 µm; sterile veins *(venae externae)* similar but the hyphae tending toward parallel alignment, in youth loosely arranged but by maturity compact. **Asci** nonamyloid, hyaline, stipitate, the sporiferous part ellipsoid to subglobose, 45-70 (-100) x 35-70 µm, abruptly narrowed to a ± cylindric, straight to sinuous stem (10-) 25-60 x 4-6 (-8) µm, the base forked; at maturity the walls have three layers, seen most clearly in cotton blue mounts: outer wall thin, inconspicuous, membranous, partially evanescent, loose and baggy around the ascus base; middle layer 3-5 µm thick; inner layer thin, inconspicuous, membranous, tightly appressed to middle layer. **Paraphyses** absent.

Spores ellipsoid, yellow to yellowish brown, 1-4 per ascus, in 1-spored asci 30-37 x 22-24 µm excluding ornamentation, in 2-spored asci 25-32 x 18-23 µm, in 3-spored asci 21-31 x 17-21 µm, in 4-spored asci 19-24 x 15-19 µm; ornamentation of subhyaline spines (1-) 2-4 x 0.3-1 µm mostly connected by lines on the spore surface to form low alveolae with (3-) 4-6 (-7) sides and numbering 7-12 along the spore length; spore walls 1-2 (-3) µm thick. Spores light brown in Melzer's reagent, the reticular ridges hyaline, in cotton blue the walls deep blue, the spines medium blue.

Etymology: in honor of H. L. Lyon, collector of the type.

Distribution, habitat and season: northeastern Mexico northwest to New Mexico, east along the Gulf Coast to Florida, north to Minnesota, and east to Connecticut and southern Québec (Fig. 2); a probable mycorrhizal associate with *Carya illinoensis* (Wangenh.) K. Koch, *C. ovata* (Mill.) K. Koch, *Crataegus* sp., *Quercus coccinea* Muenchh., *Q. macrocarpa* Michx, *Q. polymorpha* Schlecht., *Q. rysophylla* Weath., *Q. turbinella* Greene and other *Quercus* spp., and *Tilia americana* L.; June through March.

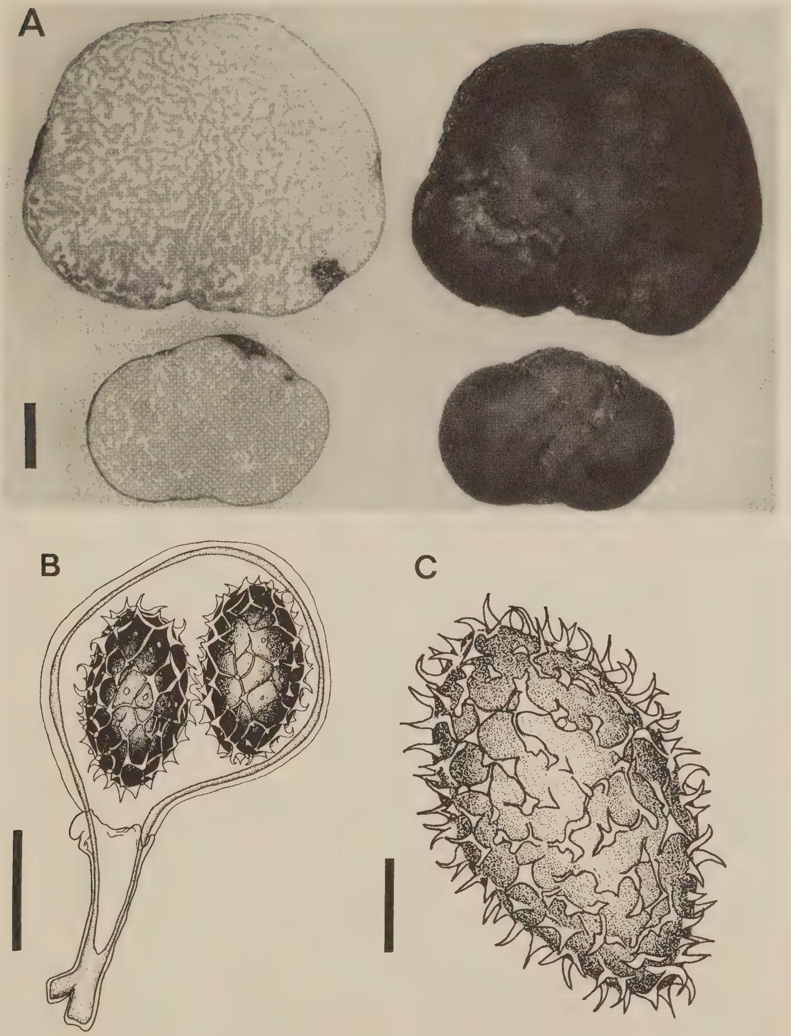


Figure 1. *Tuber lyonii.* Fig. 1A: ascomata, vertical cross section (left), surface view (right), scale bar = 1 cm. Fig. 1B: 2-spored ascus showing the loose-fitting, thin outer ascus wall and two completely reticulate spores, scale bar = 20 µm. Fig. 1C: spore with partial reticulum, scale bar = 7 µm.

Collections examined: ISOTYPE—**U. S. A.,** ***Minnesota:*** Hennepin Co., vicinity of Minneapolis, H. L. Lyon, 3 Mar. 1903 (holotype FH, isotype OSC 58742). OTHER COLLECTIONS: **Canada**, ***Québec:*** Anjou, St. Gotique, F. Marzitelli, Trappe 11601, 22 Oct. 1990 (OSC 58747); Deux Montaignes, F. Marzitelli, Trappe 15106, 7 Nov. 1993 (OSC 58751); Lachute, F. Marzitelli, Trappe 11325, 30 Oct. 1989 (OSC 58746); Montreal, Ville d'Anjou, F. Marzitelli, Trappe 11650, 4 Aug. 1990 (OSC 58748); Montreal West, leg. F. Marzitelli, Trappe 12669, 18 Oct. 1992 (OSC 58750); Park Angrignon (west of Montreal), F. Marzitelli, Trappe 12453, 25 Oct. 1991 (OSC 58749). **México,** ***Nuevo León:*** Municipio de Garza García, Chipinque, E. Cázares & J. García, 24 Sept. 1983 (ITCV as *Tuber rufum* var. *nitidum,* OSC 58767, 58774); Santiago, Camino Camotera-Potrero, E. Cázares 89, 17 Sept. 1983 (ITCV as *Tuber rufum* var. *nitidum,* OSC); Santiago, Cañón de Puerto Genovevo, E. Cázares, 8 Oct. 1982, 17 Oct. 1972, 13 Nov. 1982, & J. García, 23 Oct. 1983 (ITCV as *Tuber rufum* var. *nitidum,* OSC 58758, 58759, 58760, 58761, 58762); Santiago, Cañón del Tejocote, E. Cázares, 16 Sept. 1983 (ITCV as *Tuber rufum* var. *nitidum,* OSC 58766); Santiago, Col. Los Pescadores, E. Cázares, 8 Oct. 1983 (ITCV as *Tuber rufum* var. *nitidum,* OSC 58763); Santiago, El Barro, J. García, 27 Nov. 1983 (UNL & ITCV as *Tuber rufum* var. *nitidum,* OSC 58771, 58772); Santiago, El Cercado, J. García, 8 Oct. 1983 (ITCV as *Tuber rufum* var. *nitidum,* OSC 58773); Santiago, El Ranchito, J. García, 14 Sept. 1983 (ITCV as *Tuber rufum* var. *nitidum,* OSC 58768, 58769, 58770); Santiago, El Salto, Camino Camotera-Potrero, E. Cázares, 18 Sept. 1983 (ITCV as *Tuber rufum* var. *nitidum,* OSC 58764). ***Tamaulipas:*** Ciudad Victoria, El Madroño, J. García, 20 Oct. 1988 (ITCV as *Tuber rufum* var. *nitidum,* OSC 58776); La Palma, Carr. Cd. Victoria-Soto la Marina, J. García, 22 Oct. 1984 (ITCV as *Tuber rufum* var. *nitidum,* OSC 58775). **United States,** ***Connecticut:*** Fairfield Co., near Danbury, L. Robba, 29 Nov. 1952 (OSC 58756). ***Florida:*** St. Johns Co., St. Augustine, P. L. Dinkins, Gilkey 1186, 8 July 1964 (FLAS, OSC). ***Illinois:*** Big Rock, F. D. Merrill, 23 Aug. 1928 (BPI as *Tuber rufum,* OSC 58778). ***Iowa:*** Marshall Co., Iowa State Univ. Rhodes Farm, C. Walker, Trappe 6378, 10 Sept. 1981 (OSC 58743). ***Mississippi:*** Oktibbeha Co., W. G. Welles, Trappe 8779, 4 Dec. 1985 (OSC 58744). ***New Mexico:*** Eddy Co., Carlsbad, E. E. Staffeldt, Trappe 4079 (ITCV, OSC). ***New York:*** Dutchess Co., L. Robba, 24 Nov. 1953 (OSC 58755); Orleans Co., Medina, L. H. Weld, August (OSC 58754); Westchester Co., L. Robba, 28 Oct. 1950 and 6 Nov. 1951 (NY as *Tuber candidum,* OSC 58753, 58757). ***Ohio:*** Portage Co., near Brady Lake, S. J. Mazzer, 29 Sept. 1975 (CUP 54704 as *T. texense,* OSC 58777). ***Oklahoma:*** Tulsa Co., Tulsa, Mrs. C. Connors, Gilkey 1161, 21 Sept. 1962 (OSC). ***Tennessee:*** Johnson Co., Butler, Dale Gregg, Gilkey 823, 2 Feb. 1954 (OSC); Knox Co., near Knoxville, L. R. Hesler 8262, 24 July 1935 (OSC, TENN). ***Texas:*** Comal Co., Fischer, M. Forbes, Trappe 11146, 2 June 1989 (OSC); Glasscock Co., Garden City, R. Taber, Trappe 5975, September 1980 (OSC 58745); Harris Co., Houston, L. Guenzel, Trappe 5565, 16 Aug. 1979 (OSC); Travis Co., Austin, C. Heimsch 1 (OSC, isotype of *T. texense*). ***Wisconsin:*** Kenosha Co., Bristol Woods County Park, A. Parker, Trappe 17304, 27 Aug. 1983 (OSC 58752); Waukesha Co., 2 mi. W. of Mukwonago, J. Steinke, Trappe 17689, 17 Aug. 1993 (OSC).

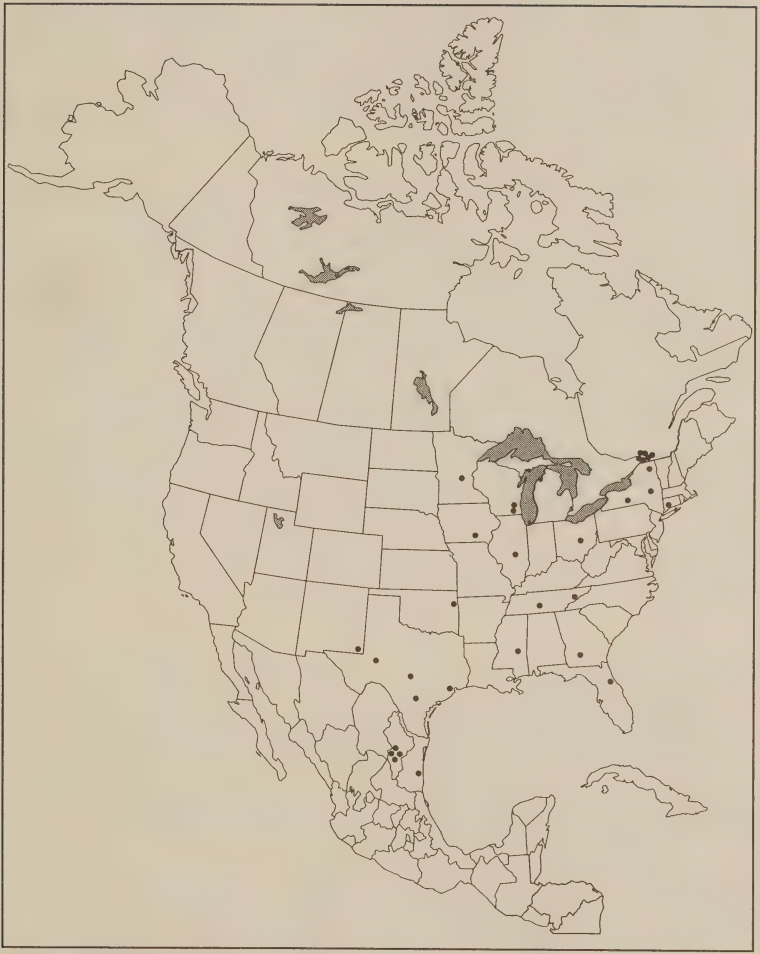


Fig. 2. Distribution of *Tuber lyonii.*

Discussion: *Tuber texense* was previously reported from Texas (Heimsch 1958), Ohio (Host & Mazzer 1982) and Georgia (Hanlin, *et al.* 1989). The type of *T. lyonii* and the other collections we examined strikingly extend the known range of this species.

We initially regarded the collections from Québec by Mdme. Marzitelli as a closely related but different taxon than *T. texense*, because the peridial epicutis was pseudoparenchymatous only in places and then not strongly so. The type of *T. lyonii* is also that way. The type of *T. texense* and other southern collections, in contrast, typically have a narrow but well developed pseudoparenchymatous epicutis. However, examination of many collections revealed this to be a highly variable character, even on individual specimens, and hence not a distinguishing trait.

The 3-layered ascus walls of *T. lyonii* were noted by Trappe (1969, as *T. texense*), who observed similar structures in the *T. rufum* Fr. and *T. excavatum* Vitt. complexes of species. He suggested that this character is so distinct from other *Tuber* spp. that it justified generic separation as Corda's proposed genus *Oogaster* (Zobel 1854). However, Uecker and Burdsall (1977) observed similar asci in still other groups of *Tuber,* and that large and diverse genus has many other intergrading groups. Consequently, we prefer not to recognize the genus *Oogaster* unless stronger evidence, especially molecular and ultrastructural, becomes available on phylogenetic relationships within the genus *Tuber.*

Most collections of *T. lyonii* have spores with consistently well developed reticula. Spores of many collections (Trappe 8779 from Mississippi and 11325 from Québec, all Mexican collections cited) contained many spores with the reticulum incomplete to occasionally lacking. This variability led Cázares *et al.* (1992) to interpret the Mexican material as *Tuber rufum* var. *nitidum* (Vitt.) Fischer. Reexamination of those collections in light of our new data on *Tuber lyonii* in the United States and Canada, however, revealed that in these cases many to most spores do have well developed reticula.

ECOLOGY

Little is known of the ecology of *T. lyonii.* Butters (1903) wrote of the type locality: "The locality where the specimens were found is a steep bank with southern exposure. The soil is a stiff calcareous clay, covered with a shallow layer of leaf-mold. At the time of collection a week of warm weather had melted the winter's snow and thawed the soil to the depth of several inches, but the clay subsoil was still frozen hard, and the surface soil had been soft for only a very few days. The fungi were found in the leaf-mold about the base of a small group of basswood trees (*Tilia americana* L.)...All the fungi collected were in a mature condition. There had hardly been time for their development this spring...It seems probable that the ascomata of the truffle are formed in the late autumn, and lie over the winter in a practically mature state."

Tuber lyonii seems to be especially common in places under *Carya illinoensis.* In transmitting his specimens (as *T. texense*) from New Mexico, Eugene Staffeldt commented: "They were found under pecan trees believed to be 25 years old. We examined a number of younger trees in this area and did not find any specimens on trees younger than 10 years old. During the day we visited 18 residences (most with 2 to 25 trees) and *T. texense* was common to most." Linda Guenzel commented on her Texas collections from under oak that "... squirrels love them. They were found just below the ground; the larger ones had pushed their way up to the surface and were visible, though still somewhat surrounded by soil." She also noted that grass appeared to die where the truffles fruited (perhaps the "brulé" or "truffle burn" phenomenon commonly observed with *Tuber melanosporum* Vitt.).

This truffle can be locally abundant. Of his Wisconsin collections, Alan Parker wrote, "I gathered approximately 110 ascocarps...at one location. A few of the fruiting bodies were partially exposed on bare soil, which led to the initial discovery; many others were located by shallow digging in the area. The collection was made in a disturbed area on the edge of an oak-hickory woods; the fruiting appeared to be associated with a species of *Crataegus."*

A KEY TO *TUBER* SPP. WITH SPINY-RETICULATE SPORES

Three *Tuber* spp. are now known to have spiny spores with the spines connected by low lines on the spore surface to form a partial to complete reticulum: *T. lyonii, T. spinoreticulatum* Uecker & Burdsall (1977), known only from the type collection in Maryland, and *T. malacodermum* Fischer (1923), known only from Germany and Switzerland. These are all closely related to the common and widely distributed *Tuber rufum* Fr. vars. *rufum* and *nitidum* , taxa with spines but no reticulum on the spores. Many collections of this group have been misidentified, as we discovered in the course of this study. Accordingly, a key is presented here. Both varieties of *T. rufum* have a number of variants, especially in spore shape (Fischer 1923) and peridial structure. These need further study to determine whether or not they represent different taxa, so we do not separate them in the key.

1. Spores with spines but no reticulum..2
1. Spores with spines and mostly with a low, partial to complete reticulum......3

    2. Ascomata distinctly verrucose........................*Tuber rufum* var. *rufum* group
    2. Ascomata glabrous to scabrous..................*Tuber rufum* var. *nitidum* group

3. Surface of ascomata with warts up to 1 mm broad.....*Tuber spinoreticulatum*
3. Surface of ascomata smooth to scabrous..4

    4. Peridial epicutis with many cells inflated to 6-10 µm................*Tuber lyonii*
    4. Peridial epicutis of cells 10-25 (-70) µm in diam.....*Tuber malacodermum*

ACKNOWLEDGMENTS

This series is a project of the North American Truffling Society (NATS). The research was supported by National Science Foundation Grants DEB 9007186 and 9400545 and the U. S. Forest Service, Pacific Northwest Research Station.

Literature Cited

Butters, F. K. 1903. A Minnesota species of *Tuber.* Bot. Gaz. 35: 427-431.

Cázares, E., J. García, J. Castillo and J. M. Trappe. 1992. Hypogeous fungi from northern Mexico. Mycologia 84: 341-359.

Fischer, E. 1923. Zur Systematik der Schweizerischen Trüffeln aus den Gruppen von *Tuber excavatum* und *rufum.* Verh. Naturforsch. Gesell. Basel 35: 34-50.

Fischer, E. 1938. Tuberineae. *In* A. Engler & H. Harms, *Die natürlichen Pflanzenfamilien, 2nd. ed., Band 5b. VIII.* 42 pp.

Gilkey, H. M. 1939. Tuberales of North America. Ore. State Mon. 1: 1-63.

Hanlin, R. T., M.-L. Wu and T. B. Brenneman. 1989. The occurrence of *Tuber texense* in Georgia. Mycotaxon 34: 387-394.

Heimsch, C. 1958. The first recorded truffle from Texas. Mycologia 50: 657-660.

Holmgren, P. K., N. H. Holmgren, and L. C. Barnett. 1990. *Index Herbariorum Part I: The Herbaria of the World. 8th Edition.* New York Botanical Garden, New York. 693 pp.

Host, G. E. and S. J. Mazzer. 1982. An Ohio record for *Tuber texense.* Ohio J. Sci. 82: 142.

Trappe, J. M. 1969. Laminated ascus walls in the Tuberales. Abstr. 11th Internat. Bot. Congress, Seattle. p. 221.

Uecker, F. A. and H. H. Burdsall, Jr. 1977. *Tuber spinoreticulatum,* a new truffle from Maryland. Mycologia 69: 626-630.

Zobel, J. B. 1854. *Augusti Car. Jos. Corda, Iconum Fungorum Hucusque Cognitorum. Tomus VI (Ultimus).* J. Cramer Reprint, 1963. 91 pp.

MYCOTAXON

Volume LX, pp. 373-386 October-December 1996

HYPHOMYCETES ON *ALCHORNEA TRIPLINERVIA* (SPRENG.) MÜELL. ARG. LEAF LITTER FROM THE ECOLOGICAL RESERVE JURÉIA-ITATINS, STATE OF SÃO PAULO, BRAZIL.

Rosely Ana Piccolo Grandi
Instituto de Botânica, CP 4005, 01061-970, São Paulo, SP, Brazil.

Derlene Silva Attili
Fundação Tropical de Pesquisas e Tecnologia "André Tosello", CP 1889, 13087-010, Campinas, SP, Brazil.

ABSTRACT

The following sixteen Hyphomycetes isolated from *Alchornea triplinervia* leaf litter, sampled at the Ecological Reserve Juréia-Itatins, are described: *Chalara aurea*, *Chloridium virescens* var. *virescens*, *Cladosporium cladosporioides*, *Cryptophiale kakombensis*, *C. udagawae*, *Cylindrocladium scoparium*, *Dictyochaeta simplex*, *Idriella falcata*, *Kionochaeta ramifera*, *Lauriomyces heliocephala*, *Mycoleptodiscus brasiliensis*, *Phaeoisaria clematidis*, *P. infrafertilis*, *Subulispora procurvata*, *S. rectilineata* and *Thozetella cristata*. This work aims to contribute to the knowledge on the fungal diversity of an important Brazilian Rain Forest Reserve, where studies of the mycota are rare.

INTRODUCTION

Hyphomycetes play an important part in the decomposition process in ecosystems. The leaf litter is one of the most diverse habitats, exhibiting an intense microbial colonization, which can develop inside the leaf or on its surface (Cooke & Rayner, 1984). In Brazil there are very few works on saprobic Hyphomycetes in the local literature. The Ecological Reserve Juréia-Itatins (ERJI), on the south coast of the State of São Paulo, is considered one of the most representative areas of the Brazilian tropical ecosystems (Cortesão, 1989). Only three studies on soil fungi from this area have appeared (Attili, 1994; Chatanon *et al.*, 1994; Garlipp, 1995). In this paper, Hyphomycetes isolated from decomposing leaves of *Alchornea triplinervia* are identified and characterized, also contributing to the knowledge on the geographical distribution of these taxa.

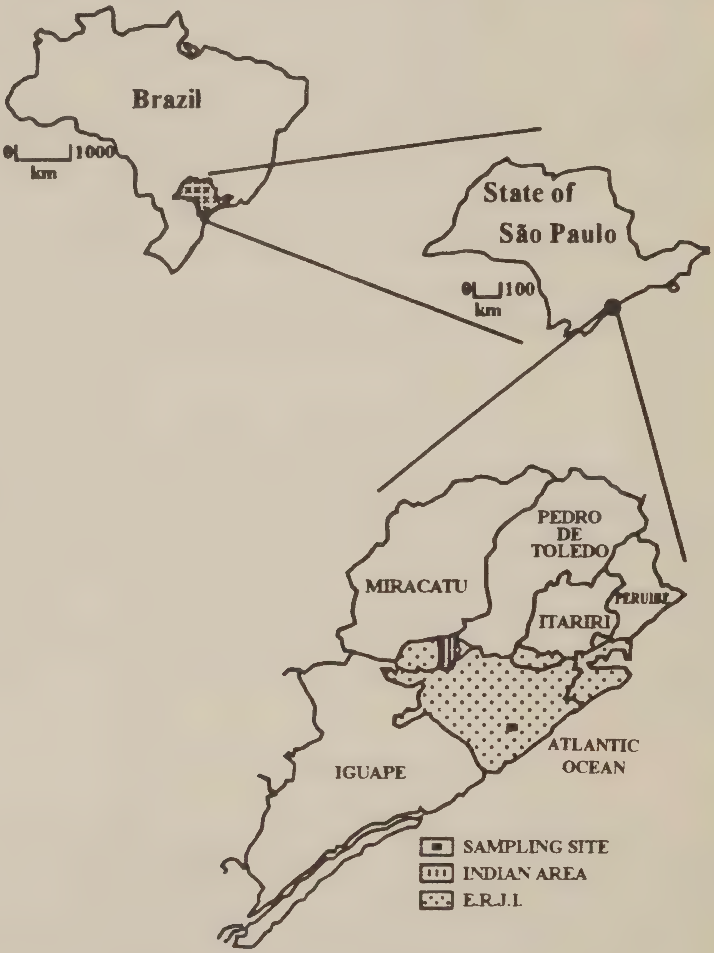

Brazil
0
1000
km
State of
São Paulo
0
100
km
PEDRO
DE
TOLEDO
MIRACATU
PERUIBE
ITARIRI
IGUAPE
ATLANTIC
OCEAN
SAMPLING SITE
INDIAN AREA
E.R.J.I.

Fig. 1. Ecological Reserve Juréia-Itatins (E.R.J.I), SP.

The Ecological Reserve Juréia-Itatins

The study area is located between 24°18'47"-24°36'10" S and 47°00'03" - 47°30'07" W (Fig. 1). Main climatic characteristics are: mean air temperatures between 35-15°C, high relative air humidity (80-100%), rarely under 50%; high rain fall (annual average above 3,400mm), and a less-rainy season during autumn-winter (Attili *et al.*, 1995). Under these conditions there are a great variety of ecosystems such as dunes, mangrove, "restingas", lowland forests, luxuriant rain forest, montane vegetation and elevations (Cortesão, 1989). The collecting site is known as "Banhado Grande", in the middle of the Reserve.

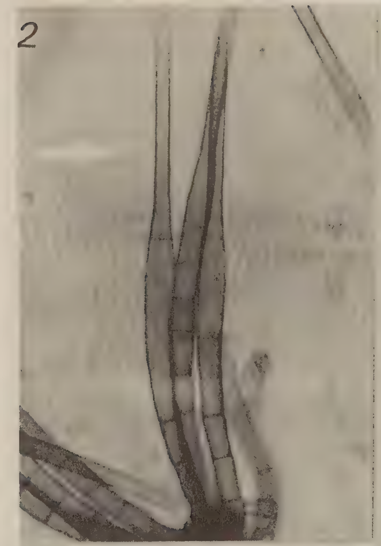
MATERIALS AND METHODS

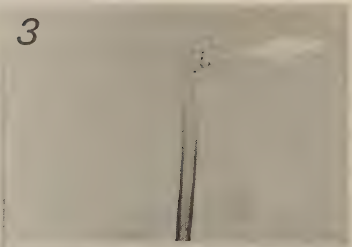
Decomposing leaves of *Alchornea triplinervia,* a common member of the Euphorbiaceae in the ERJI, were used as substrate for the isolation of the Hyphomycetes. Samplings were carried out in January, April, July and October 1991 and May 1993, resulting in 25 leaf samples. A washing technique with 15 serial changes of sterile distilled water (Harley & Waid, 1955) was applied to the leaf litter. Leaf fragments were left in moist chambers at room temperature until the development of fungal structures. Identifications were made based on slide mountings prepared with lactophenol cotton-blue or PVL resin mounting media (Trappe & Schenck, 1982). Preserved specimens were deposited in the "Herbário Científico Maria Eneyda P. Kauffmann Fidalgo" (SP), at the "Instituto de Botânica", State of São Paulo, Brazil.

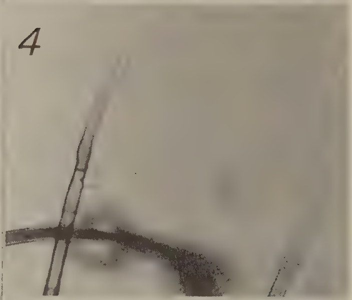
RESULTS

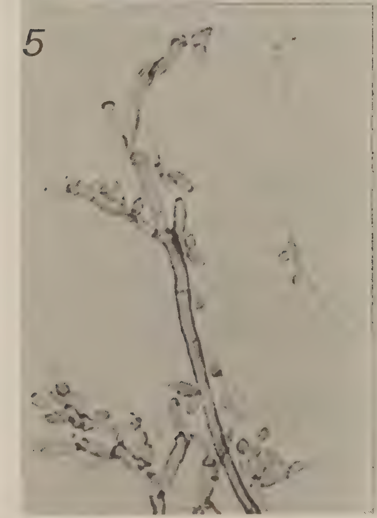
The following taxa were isolated during the collecting period:
Chalara aurea (Corda) Hughes in Can.J.Bot., 36: 747, 1958 (Fig. 2).
Conidiophores erect, single or in groups, cylindrical, brown, septate, smooth, 20.0-67.0 x 5.0-6.5 µm. **Conidiogenous cells** phialidic, integrated, erect, brown, smooth, cylindrical or lageniform, with gradual transition venter/collarette, 77.5-102.5 x 5.5-7.0 µm. Venter with superior limite slightly pronounced; tubular collarette. **Conidia** enteroblastic, catenate, hyaline, cylindrical with truncate ends, 1-septate, smooth-walled, 15.0-18.5 x 2.0-3.0 µm.
Material examined: SP250853.
Literature consulted: Nag Raj & Kendrick, 1975; Holubová-Jechová, 1984.

Chloridium virescens (Pers.) W. Gams & Hol.-Jech. var. *virescens* in Stud. Mycol., 13: 17, 1976 (Fig. 3-4).
Conidiophores erect, single or rarely in groups, brown, septate, smooth, unbranched, proliferating percurrently through the collarette, 85.5-207.0 x 3.5-5.0 µm. **Conidiogenous cells** phialidic, integrated, terminal, light brown, smooth, cylindrical, collarette distinct or not. **Conidia** 1-celled, hyaline, ovoid, smooth-walled, with basal apiculus, formed at multiple loci and aggregated in slimy heads at the apex of the phialide, 2.5-3.0 x 2.0-2.5µm.
Material examined: SP250849.
Literature consulted: Romero, 1983.









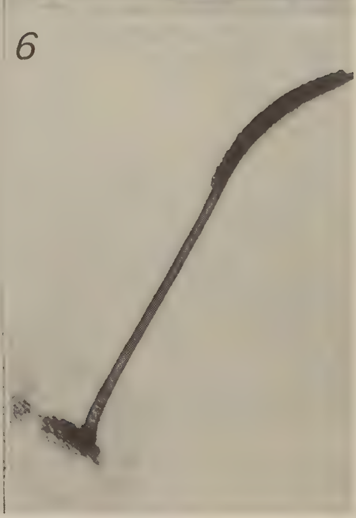


Fig. 2. *Chalara aurea* (x 1560), the arrow indicates a phialide. Fig. 3-4. *Chloridium virescens* var. *virescens* (x 1560); 3. slimy head of conidia (arrow); 4. phialide with multiple loci. Fig. 5. *Cladosporium cladosporioides* (x 1600). Fig. 6. *Cryptophiale kakombensis* (x 480).

Cladosporium cladosporioides (Fres.) De Vries in Contribution to the knowledge of the genus *Cladosporium* Link ex Fr., p.57, 1952 (Fig. 5).
Conidiophores erect, dark-brown, septate, smooth, branches at the apex forming conidial chains, 72.0-426.0 x 6.0-7.5 µm. **Conidiogenous cells** blastic, ramoconidia cylindrical, light brown, smooth, 1-2-celled, scars at the ends, 14.0-18.5 x 4.5-5.0 µm. **Conidia** blastic, usually 1-celled, light-brown, ellipsoidal with pointed ends, lemon-shaped or cylindrical, smooth-walled, with prominent scars, joined in branched chains, 3.0-7.0 x 2.0-3.5 µm.
Material examined: SP250851.
Literature consulted: Domsch *et al.*, 1980.

Cryptophiale kakombensis Pirozynski in Can. J. Bot., 46: 1124, 1968 (Fig. 6).
Conidiophores erect or slightly curved, setiform, single, dark-brown, septate, smooth, thick-walled, 172.0-275.0 x 6.5-10.5 µm, tapering to a pointed tip; fertile zone light-brown, at the superior part of the conidiophore but leaving the apex visible, formed by two layers of cells resembling a plate, at both sides of the conidiophore. **Conidiogenous cells** phialidic, obscured by the cell layer. **Conidia** phialidic, 2-celled, hyaline, narrow and falcate, smooth-walled, aggregated in a slimy mass at one side of the fertile zone, 25.0-30.0 x 1.0-1.5 µm.
Material examined: SP250842, SP250843.
Literature consulted: Sutton *et al.*, 1989.

Cryptophiale udagawae Pirozynski & Ichinoe in Can. J. Bot., 46: 1126, 1968 (Fig. 7).
Conidiophores erect or slightly curved, setiform, single, brown, septate, smooth, thick-walled, 102.0-161.5 x 5.0-8.0 µm, 1-3 pointed dichotomous branches at the apex; fertile zone light-brown from the upper half of the conidiophore towards its first branch, with two layers of cells resembling a plate, at both sides of the conidiophore; enlarged cells in the basal region. **Conidiogenous cells** phialidic, obscured by the shielding cell layer. **Conidia** phialidic, 1-2-celled, hyaline, narrow and falcate, smooth-walled, aggregated in a slimy mass in the fertile zone, 14.0-17.0 x 1.0-1.5 µm.
Material examined: SP250841.
Literature consulted: Sutton *et al.*, 1989.

Cylindrocladium scoparium Morgan in Bot. Gaz., 17: 191, 1892 (Fig. 8-9).
Conidiophores erect, hyaline, septate, smooth, apex irregularly branched; elongate appendages generally present, delicate, septate, hyaline, smooth and terminating in a clavate vesicle of 13.5-20.0 x 4.0-8.0 µm at the end. **Conidiogenous cells** phialidic, arising from the ultimate branches of the conidiophores, 11.5-14.0 x 2.0-2.5 µm. **Conidia** phialidic, 1-septate, hyaline, cylindrical, smooth-walled, single on the phialides, but aggregated in a slimy mass, 42.0-59.0 x 3.5-4.5 µm.
Material examined: SP250835.
Literature consulted: Peerally, 1991; Crous & Wingfield, 1994.

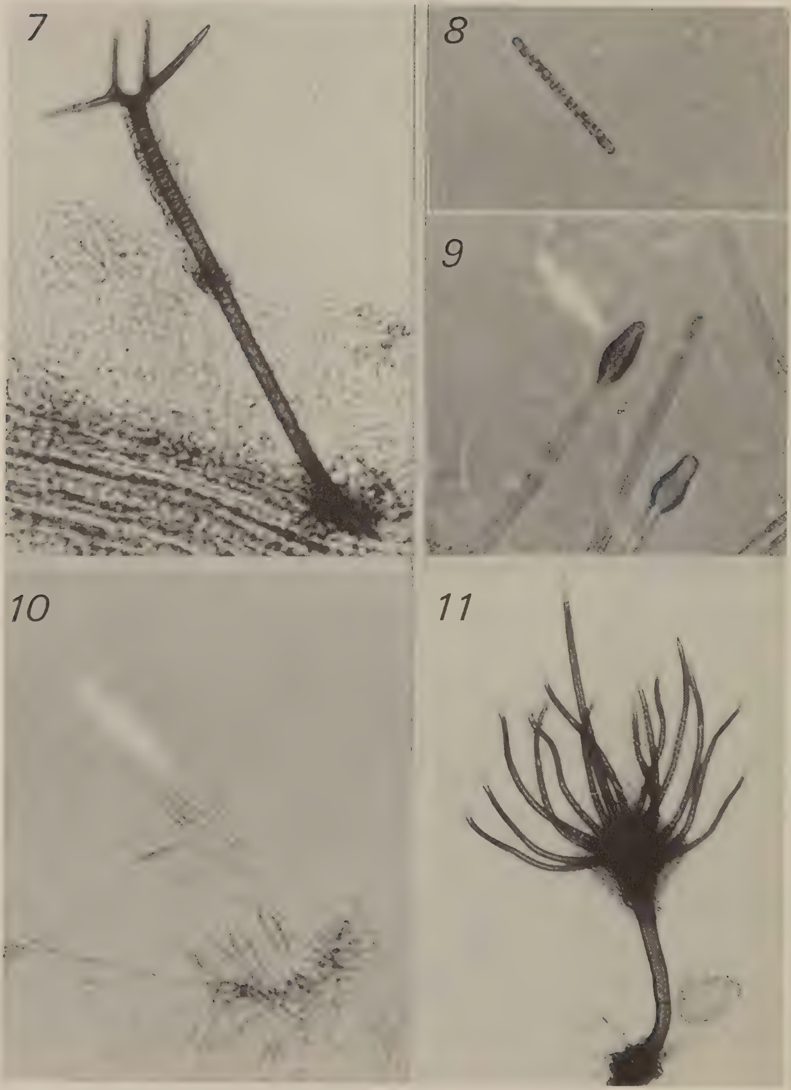


Fig. 7. *Cryptophiale udagawae* (x 830). Fig. 8-9. *Cylindrocladium scoparium*; 8. conidium (x 840); 9. apical vesicle (arrow) (x 1680). Fig. 10. *Idriella falcata* (x 1140), a conidial cluster (arrow). Fig. 11. *Kionochaeta ramifera* (x 500).

Dictyochaeta simplex (Hughes & Kendrick) Hol.-Jech. in Folia Geobot. Phytotax., 19: 434, 1984 (Fig. 21).
Conidiophores erect, single or in groups of 2-3, brown, scarcely septate, smooth, unbranched, 45.0-71.0 x 2.5-4.0 µm including the phialide; setae absent. **Conidiogenous cells** phialidic, integrated, terminal, light-brown, cylindrical, with a conspicuous collarette and sympodial growth (polyphialides). **Conidia** phialidic, 1-celled, hyaline, lunate, smooth-walled, a setula at both ends, 15.0-19.0 x 2.0-3.0 µm, aggregated in a slimy mass at the apex of the phialides. Setula filiform, hyaline, 7.0-9.0 µm.
Material examined: SP250852.
Literature consulted: Hughes & Kendrick, 1968 (as *Codinaea simplex*)

Idriella falcata (Sutton & Hodges) von Arx in Sydowia, 34: 36, 1981 (Fig. 10, 23).
Conidiophores erect or flexuous, single, few to numerous, hyaline, delicate, smooth, loosely aggregated, irregularly branched at the apex with the terminal branches being the conidiogenous cells. **Conidiogenous cells** polyblastic and sympodial, terminal, hyaline, delicate, subulate with inconspicuous denticles at the apex, 9.5-14.0 x 1.0-2.5 µm. **Conidia** 1-celled, hyaline, slightly falcate, smooth-walled, with a lighter central zone, 20.0-26.0 x 1.5-2.0 µm.
Material examined: SP250855.
Literature consulted: Sutton & Hodges Jr., 1976 (as *Microdochium falcatum*).

Kionochaeta ramifera (Matsushima) Kirk & Sutton in Trans. Br. Mycol. Soc., 85: 715, 1985 (Fig. 11, 24).
Conidiophores erect, setiform, single, brown, septate, smooth, thick-walled, 194.0-307.0 x 8.0-11.5 µm; with 1-14 setiform lateral branches, septate, brown and smooth, arising approximately at the mid part of the conidiophore, from where the fertile zone also diverges. **Conidiogenous cells** phialidic, lageniform, light-brown, smooth, densily aggregated at the fertile zone. **Conidia** 1-celled, hyaline, falcate, smooth-walled, aggregated in a slimy mass in the fertile zone, 7.0-8.0 x 0.5-1.0 µm.
Material examined: SP250838, SP250839, SP250840.
Literature consulted: Matsushima, 1971 (as *Chaetopsina ramifera*); Kuthubutheen & Nawawi, 1988.

Lauriomyces heliocephala (V. Rao & de Hoog) Cast. & Kendr. in Univ. Waterloo Biol. Ser., 32: 26, 1990 (Fig. 12, 25).
Conidiophores erect or recurved, single or in small groups, brown, septate, smooth, with a complex sporogenous apparatus at the apex, 62.5-98.5 (-187.5) x 4.0-6.0 µm at the base; some clusters of conidiophores associated with long filaments resembling setae. **Conidiogenous apparatus** hyaline, formed by conidial chains, in dry spherical heads. **Conidia** 1-celled, hyaline, cylindrical, smooth-walled, 4.5-5.0 x 1.0-1.5 µm.
Material examined: SP250854.
Literature consulted: Rao & Hoog, 1986 (as *Haplographium heliocephalum*).

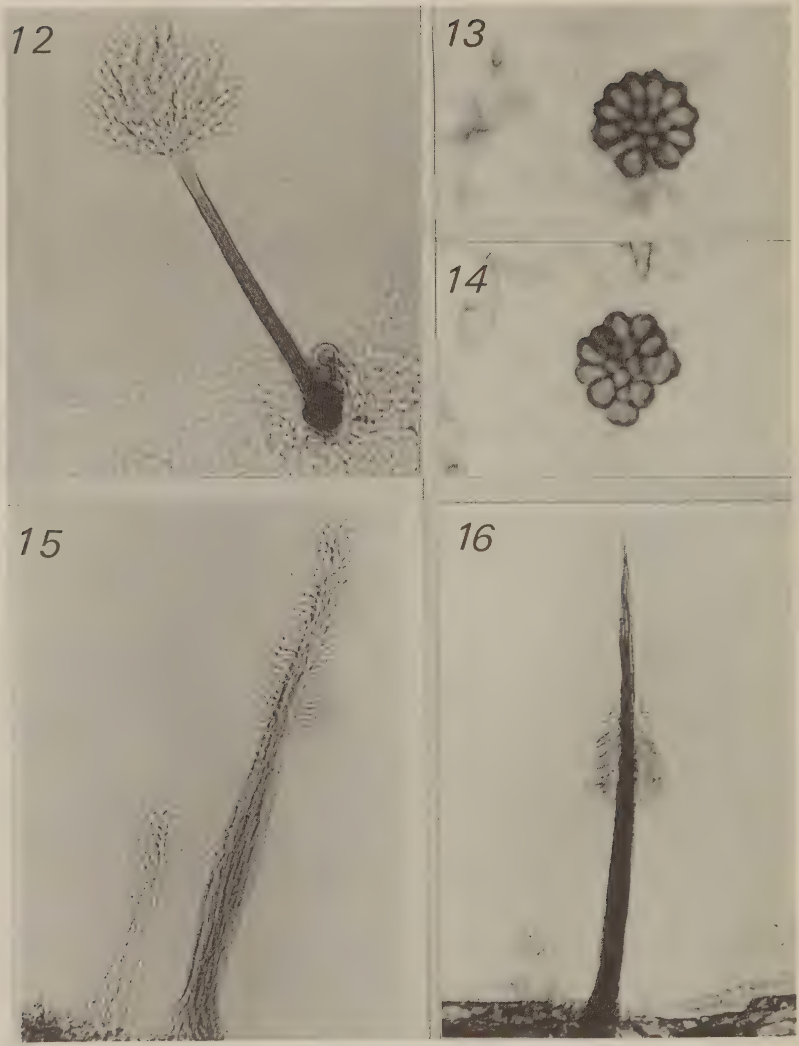


Fig. 12. *Lauriomyces heliocephala* (x 990). Fig. 13-14. *Mycoleptodiscus brasiliensis* (x 1560), small sporodochia. Fig. 15. *Phaeoisaria clematidis* (x 625). Fig. 16. *Phaeoisaria infrafertilis* (x 625).

Mycoleptodiscus brasiliensis Sutton & Hodges Jr. in Nova Hedwigia, 27: 694, 1976 (Fig. 13-14).
Conidiophores slightly differentiated or indistinct. Only two small specimens were observed, with superficial dark-brown sporodochia, spherical, one-celled width, 20.0-24.5 μm diameter. **Conidiogenous cells** phialidic, ampulliform or doliiform, dark-brown, strongly compacted, thick-walled, 6.0-8.0 x 4.0-5.5 μm, circular apical opening, conspicuous collarette. **Conidia** not observed.
Material examined: SP250844.
Literature consulted: Sutton & Alcorn, 1990.

Phaeoisaria clematidis (Fckl.) Hughes in Can. J. Bot., 36: 795, 1958 (Fig. 15, 26).
Conidiomata synnematous, erect, light-brown or yellowish, sometimes branched, 262.5-791.5 x 23.0-52.5 μm; fertile zone approximately 2/3 of the synnema from the apex. **Conidiophores** adpressed, densily compact at the base tapering towards the apex. **Conidiogenous cells** oblong, light-brown to hyaline, sinuate, denticulate, exhibiting sympodial growth. **Conidia** 1-celled, hyaline, ellipsoidal to obovoid, smooth-walled, 4.0-5.5 x 1.0-1.5 μm.
Material examined: SP250845.
Literature consulted: Deighton, 1974; Hoog & Papendorf, 1976.

Phaeoisaria infrafertilis Sutton & Hodges Jr. in Nova Hedwigia, 27: 219, 1976 (Fig. 16, 27).
Conidiomata synnematous, erect, dark-brown, unbranched, 250.0-500.0 x 12.0-19.5 μm; fertile zone limited to the central part of the synnema, white coloured. **Conidiophores** adpressed, septate and slender, densily compact at the base tapering towards the apex. **Conidiogenous cells** divergent, light-brown, denticulate, exhibiting sympodial growth. **Conidia** 1-celled, hyaline, falcate, smooth-walled, acute at the base, 14.0-19.5 x 0.5-1.0 μm.
Material examined: SP250846, SP250847, SP250848.
Literature consulted: Kirk, 1985.

Subulispora procurvata Tubaki in Trans. Mycol. Soc. Japan, 12: 20, 1971 (Fig. 17-18).
Conidiophores erect, straight or slightly curved, single, brown, septate, smooth, unbranched, 52.5-106.5 x 3.5-4.5 μm; basal cell lobate, apex with lighter fertile zone. **Conidiogenous cells** polyblastic, integrated, apical, zigzag-like, sympodial growth, thin scars present. **Conidia** 3-septate, hyaline, subuliform, smooth-walled, truncate at the base, 21.0-26.0 x 2.0-3.0 μm, with apical appendage. Appendages filiform and hyaline, frequently forming an angle of 45-135° in relation to the main axis of the conidia, 9.0-17.0 μm long.
Material examined: SP250836.
Literature consulted: Matsushima, 1971.

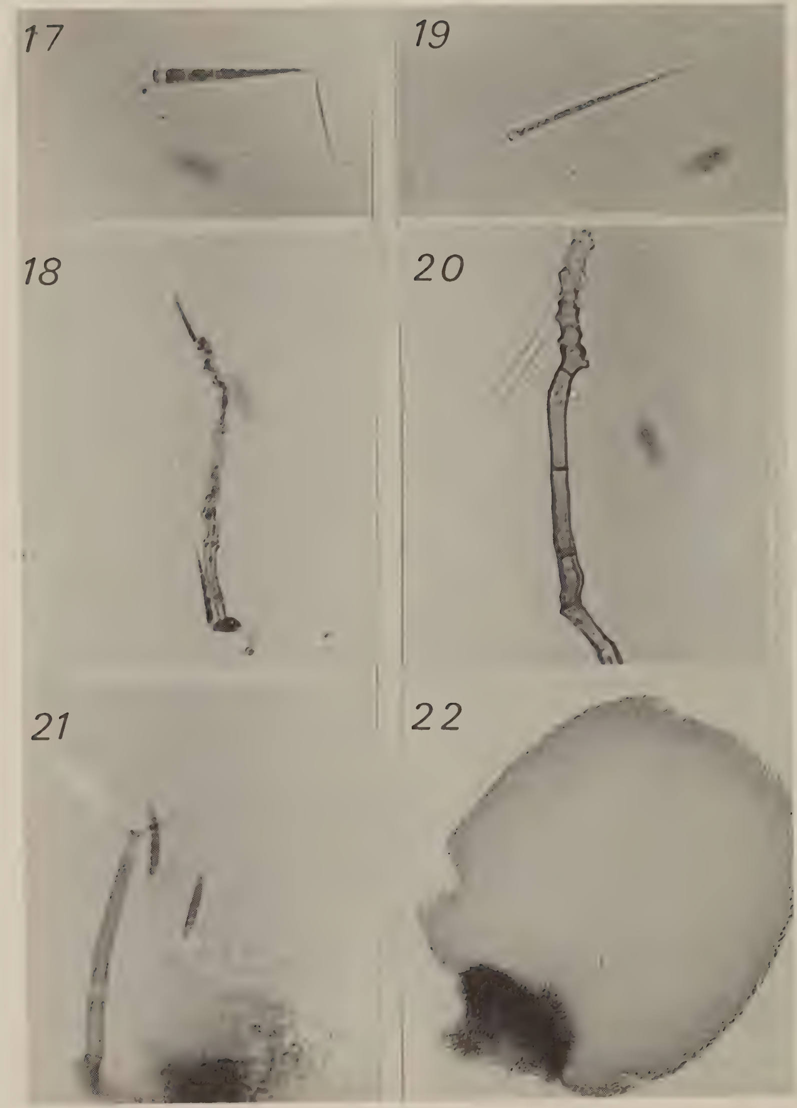


Fig. 17-18. *Subulispora procurvata*; 17. conidium (x 1870); 18. conidiophore (x 980). Fig. 19-20. *Subulispora rectilineata* (x 1870); 19. conidium; 20. conidiophore. Fig. 21. *Dictyochaeta simplex* (x 1560), the arrow indicates the collarette. Fig. 22. *Thozetella cristata* (x 390).

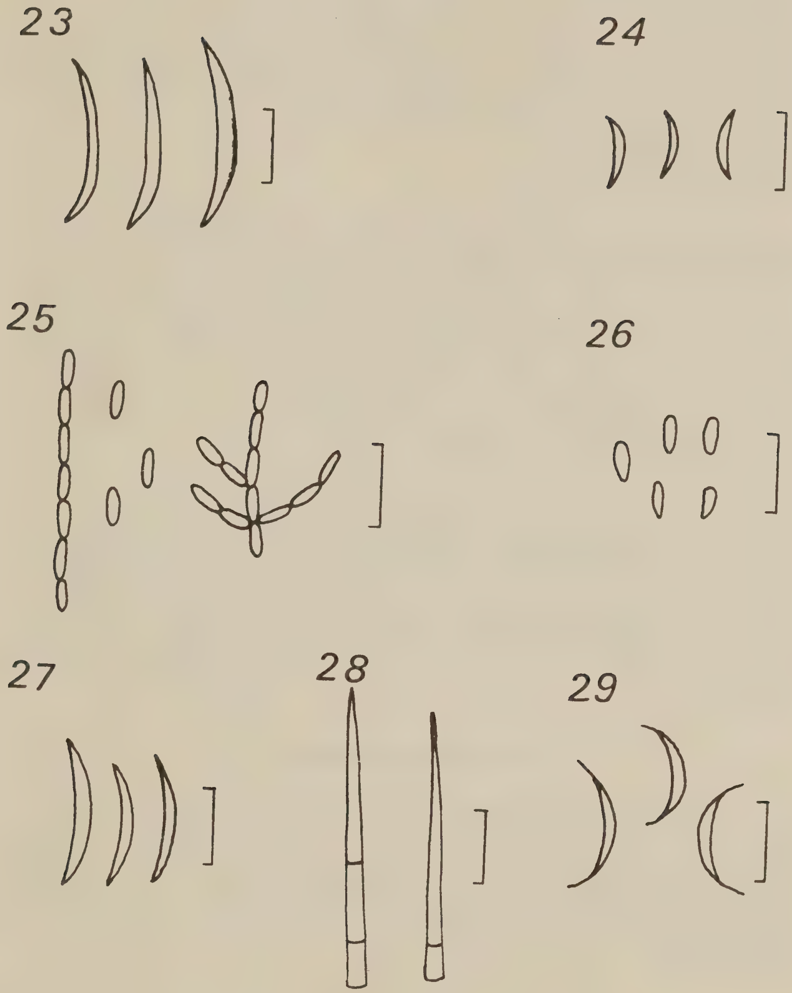


Fig. 23. *Idriella falcata*: conidia. Fig. 24. *Kionochaeta ramifera*: conidia. Fig. 25. *Lauriomyces heliocephala*: conidia. Fig. 26. *Phaeoisaria clematidis*: conidia. Fig. 27. *Phaeoisaria infrafertilis*: conidia. Fig. 28. *Subulispora rectilineata*: conidia. Fig. 29. *Thozetella cristata*: conidia. Scale bars = 10 µm.

Subulispora rectilineata Tubaki in Trans.Mycol.Soc.Japan, 12:21,1971(Fig.19-20, 28). **Conidiophores** erect, straight or slightly curved, single, brown, septate, smooth, unbranched, 26.0-73.0 x 3.0-5.0 µm; basal cell lobate, fertile zone at the apex. **Conidiogenous cells** polyblastic, integrated, terminal, zigzag-like, sympodial growth, typical scars present. **Conidia** 1-2-septate, hyaline, subuliform, smooth-walled, truncate at the base, tapering at the apex, 35.0-41.5 x 1.5-2.0 µm.
Material examined: SP250837.
Literature consulted: Hoog, 1985.

Thozetella cristata Pirozynski & Hodges Jr. in Can. J. Bot., 51:168,1973 (Fig. 22, 29). **Conidiomata** synnematous, erect, light-brown, transverse growth zone present or not, 64.5-110.5 x 38.0-54.0 µm. **Conidiophores** densily compact, hyaline when separated, septate, with one phialide at the apex. **Conidiogenous cells** phialidic, hyaline, cylindrical or bacilliform, smooth. **Conidia** 1-celled, hyaline, lunate, smooth-walled, hyaline setule at the ends, 9.0-14.5 x 1.0-2.0 µm. Microawns falcate or sigmoid, hyaline, smooth-walled and refracting at the fertile zone.
Material examined: SP250850.
Literature consulted: Pirozynski & Hodges Jr., 1973.

CONCLUSIONS

The study of filamentous fungi at the ERJI is in a pioneering stage. The results give important information about the geographical distribution of the following taxa that are mentioned for the first time in Brazil: *Lauriomyces heliocephala* and *Subulispora rectilineata*. This paper represents an identification aid for other researchers in this wild tropical area and contributes to the knowledge on its fungal biodiversity.

ACKNOWLEDGEMENTS

The authors are deeply indebted to Mr. Marcos G. Sobral (Universidade Federal do Rio Grande do Sul) for his help on collecting the *Alchornea triplinervia* leaves. We also thank Mrs. Cristina Y. Umino and Miss Lilian D. Martins (Fundação Tropical "André Tosello") for assistance with the photographs and the drawings, respectively, and Dr. Keith Seifert (Agriculture and Agri-Food, Canada) for revising this manuscript.

LITERATURE CITED

ARX, J.A. von. 1981. Notes on *Microdochium* and *Idriella*. *Sydowia*, 34: 30-38.

ATTILI, D.S. 1994. **Isolamento, identificação e ecologia de fungos celulolíticos do solo da Estação Ecológica de Juréia-Itatins, SP.** Rio Claro, UNESP, 148 p. Tese (Doutorado) - Instituto de Biociências, Universidade Estadual Paulista.

ATTILI, D.S., ZAVATINI, J.A., PINTO, I.M.A. 1995. Características climáticas da Estação Ecológica de Juréia-Itatins, Mata Atlântica, São Paulo, Brasil. *Geografia*, 20 (1), in press.

CASTAÑEDA RUIZ, R.F., KENDRICK, B. 1990. Conidial fungi from Cuba: I. Univ. Waterloo Biol. Ser., 32: 1-53.

CHATANON, L., KIGAWA, R., KAWASAKI, H., ATTILI, D.S., CANHOS, V.P., KURAISHI, H., SUGIYAMA, J. 1994. The diversity of soil microfungi in the Atlantic Rain Forest of Brazil: a preliminary taxonomic analysis. In: Annual Reports of International Center of Cooperative Research in Biotechnology. Japan, v. 17.

COOKE, R.C., RAYNER, A.D.M. 1984. **Ecology of saprotrophic fungi.** Longman, New York. 415 p.

CORTESÃO, J. 1989. **Juréia**. Ed. Index, São Paulo. 133 p.

CROUS, P.W., WINGFIELD, M.J. 1994, A monograph of *Cylindrocladium*, including anamorphs of *Calonectria*. *Mycotaxon*, 51: 341-435.

DE VRIES, G.A. 1952. **Contribution to the knowledge of the genus *Cladosporium* Link ex Fr.** Uitgeverij & Drukkerij Hollandia, Baarn. 121 p.

DEIGHTON, F.C. 1974. Four synnematous Hyphomycetes. *Trans. Br. mycol. Soc.*, 62 (2): 243-252.

DOMSCH, K.H., GAMS, W., ANDERSON, T.-H. 1980. **Compendium of soil fungi.** Academic Press, London, V. 1. 859 p.

GAMS, W. , HOLUBOVÁ-JECHOVÁ, V. 1976. *Chloridium a*nd some other dematiaceous hyphomycetes growing on decaying wood. *Stud. Mycol.*, 13: 1-99.

GARLIPP, A.B. 1995. **Isolamento e identificação de fungos filamentosos do solo do Banhado Grande, na Estação Ecológica de Juréia-Itatins, SP.** Rio Claro, UNESP, 94 p. Dissertação (Mestrado) - Instituto de Biociências, Universidade Estadual Paulista.

HARLEY, J.L., WAID, J.S. 1955. A method of studying active mycelia on living roots and other surfaces in the soil. *Trans. Br. mycol. Soc.*, 38: 104-118.

HOLUBOVÁ-JECHOVÁ, V. 1984. Lignicolous Hyphomycetes from Czechoslovakia 7. *Chalara*, *Exochalara*, *Fusichalara* and *Dictyochaeta*. *Folia Geobot. Phytotaxon.* , 19: 387-438.

HOOG, G.S. 1985. Taxonomy of the *Dactylaria* complex. IV. *Dactylaria*, *Neta*, *Subulispora* and *Scolecobasidium*. *Stud. Mycol.*, 26: 1-60.

HOOG, G.S., PAPENDORF, M.C. 1976. The genus *Phaeoisaria*. *Persoonia*, 8 (4): 407-414.

HUGHES, S.J. 1958. Revisiones hyphomycetum aliquot cum appendice de nominibus rejiciendis. *Can. J. Bot.* , 36: 727-836.

HUGHES, S.J., KENDRICK, W.B. 1968. New Zealand fungi. 12. *Menispora*, *Codinaea*, *Menisporopsis*. *N.Z.J. Bot.*, 6: 323-375.

KIRK, P.M. 1985. New or interesting microfungi. XIV. Dematiaceous Hyphomycetes from Mt. Kenya. *Mycotaxon*, 23: 305-352.

KIRK, P.M., SUTTON, B.C. 1985. A reassessment of the anamorph genus *Chaetopsina* (Hyphomycetes). *Trans. Br. mycol. Soc.*, 85 (4): 709-717.

KUTHUBUTHEEN, A.J., NAWAWI, A. 1988. Two new species of *Kionochaeta* (Hyphomycetes) and *K. ramifera* from Malaysia. *Trans. Br. mycol. Soc.*, 90 (3): 437-444.

MATSUSHIMA, T. 1971. Microfungi of the Solomon Islands and Papua-New Guinea. Nippon Printing, Osaka. 78 p. (published by the author).

MORGAN, A.P. 1892. Two new genera of Hyphomycetes. *Bot. Gaz.*, 17: 190-192.

NAG RAJ, T.R., HUGHES, S.J. 1975. **A monograph of *Chalara* and allied genera.** Wilfr. Laurier Univ. Press, Waterloo. 200 p.

PEERALLY, A. 1991. The classification and phytopathology of *Cylindrocladium* species. *Mycotaxon*, 40: 323-366.

PIROZYNSKI, K.A. 1968. *Cryptophiale*, a new genus of Hyphomycetes. *Can. J. Bot.*, 46: 1123-1127.

PIROZYNSKI, K.A., HODGES JR., C.S. 1973. New Hyphomycetes from South Carolina. *Can. J. Bot.*, 51: 157-173.

RAO, V. , HOOG, G.S. 1986. New or critical Hyphomycetes from India. *Stud. Mycol.*, 28: 1-84.

ROMERO, A.I. 1983. Contribucion al estudio de los hongos xilofilos de la Argentina. I. Deuteromycotina en *Eucalyptus viminalis* (Myrtaceae). *Bol. Soc. Argent. Bot.*, 22 (1-4): 57-79.

SUTTON, B.C., ALCORN, J.L. 1990. New species of *Mycoleptodiscus* (Hyphomycetes). *Mycol. Res.*, 94: 564-566.

SUTTON, B.C., HODGES Jr., C.S. 1976. *Eucalyptus* microfungi: *Microdochium* and *Phaeoisaria* species from Brazil. *Nova Hedwigia*: 27: 215-222.

SUTTON, B.C., HODGES Jr., C.S. 1976. *Eucalyptus* microfungi: *Mycoleptodiscus* species and *Pseudotracylla* gen. nov. *Nova Hedwigia*: 27: 693-700.

SUTTON, B.C., NAWAWI, A., KUTHUBUTHEEN, A.J. 1989. Additions to *Belemnospora* and *Cryptophiale* from Malaysia. *Mycol. Res.*, 92(3): 354-358.

TRAPPE, J.M., SCHENCK, N.C. 1982. Taxonomy of the fungi forming endomycorrhizae. In: Schenck, N.C. (ed.). **Methods and principles of mycorrhizae research.** St. Paul: The American Phytopathological Society. p.1-9.

TUBAKI, K., YOKOYAMA, T. 1971. Notes on the japanese Hyphomycetes V. *Trans. Mycol. Soc. Japan*, 12: 18-28.

MYCOTAXON

Volume LX, pp. 387-395 October-December 1996

BRIDGEOPORUS, A NEW GENUS TO ACCOMMODATE OXYPORUS NOBILISSIMUS (BASIDIOMYCOTINA, POLYPORACEAE)

Harold H. Burdsall, Jr., Thomas J. Volk,
Center for Forest Mycology Research,
Forest Products Laboratory *, Forest Service, United States Department of Agriculture, One Gifford Pinchot Dr., Madison, WI 53705 USA

& **Joseph F. Ammirati, Jr.**
Department of Botany, KB-15, University of Washington,
Seattle WA 98195 USA

ABSTRACT: The new genus *Bridgeoporus* is proposed to accommodate *Oxyporus nobilissimus* W.B. Cooke. *Bridgeoporus* is associated with a brown rot of wood, as opposed to the superficially similar genera *Oxyporus* and *Rigidoporus*, which are associated with white rot. *Bridgeoporus* lacks clamp connections at the septa, is monomitic, possesses pseudocystidia, and has a unique configuration of fascicles of hyphae making up the upper surface of its pileus. This combination of characters is found in no previously described genus.

* The Forest Products Lab is maintained in cooperation with the University of Wisconsin-Madison. This publication was written and prepared by U.S. government employees on official time, and it is therefore in the public domain and not subject to copyright.

INTRODUCTION

Oxyporus nobilissimus W.B. Cooke (Cooke, 1949) has attracted a great deal of attention in the past several years (Christy, 1991; Coombs, 1991) because of its large size, uncommon occurrence, unique appearance, and association with very large host trees. Commonly called the "Fuzzy Sandozi," it has been reported infrequently (WTU Herbarium records; Trappe, 1990; Christy, 1991) since its discovery in 1943. Currently, living specimens are known from only six sites in Oregon and Washington. The fungus produces perennial basidiomata that may weigh up to up to 130 kg and are usually associated with large diameter (at least 1 m) *Abies procera* Rehd., but occasionally with equally large *Abies amabilis* (Dougl.) Forb. or possibly *Tsuga heterophylla* (Raf.) Sarg. It is the first fungus to be listed as an endangered species by any private or public agency in the United States, having been listed as such by the Oregon Natural Heritage program (Christy, Pers. Comm.; Lizon, 1995). *O. nobilissimus* has also been listed by the Forest Ecosystem management team (FEMAT; anon., 1994) as one of 252 species of fungi that must be surveyed for in the habitat of the northern spotted owl.

The genus *Oxyporus* (Bourd. & Galz.) Donk accommodates species with a monomitic hyphal system, simple-septate hyphae, and causing white rot. *Oxyporus nobilissimus* has been reported to cause a brown rot (Cooke, 1949), but the species has been left in *Oxyporus* (*e.g.*, by Gilbertson & Ryvarden, 1987) because of a lack of specific studies demonstrating the type of rot. It has also been placed in *Fomes* (Fr.) Fr. (Lowe, 1955). However, because of the following combination of characteristics, i.e. simple-septate hyphae, association with brown rot, pseudocystidia of tramal origin, and closely-appressed hyphae in fascicles making up the upper surface of its pileus, it is being placed in a new genus, *Bridgeoporus*.

METHODS AND MATERIALS

Relatively small (5-6 cm) portions of basidiomata were carefully excised from living specimens and cultured according to Gilbertson & Ryvarden (1986) on 1.5% malt extract 2% agar, plus 2 mg/l benomyl and 100 mg/l streptomycin. Microscopic characters of the basidiomata were determined by mounting thin sections in 3% KOH plus 1% phloxine or in Melzer's reagent (Gilbertson & Ryvarden, 1986). Line drawings were made with the aid of a camera lucida and drawing tube. Putative cultures and portions of basidiomata have been preserved at CFMR, Madison, Wisconsin. Herbarium abbreviations are as in Holmgren *et al.* (1990). Colors are as in Ridgway (1912). PCR amplification and sequencing was performed according to Nakasone & Sytsma (1993).

RESULTS AND DISCUSSION

Although collected basidiospores failed to germinate, we collected a number of putative cultures from tissues of four basidiomata and from the brown-rotted wood. We amplified and sequenced the internal transcribed spacer (ITS) region of the ribosomal DNA repeat from DNA obtained from basidiospore drops and from putative cultures; the DNA sequence from the spore drops (two samples) and 3 putative cultures did not match. Thus we could not positively conclude that any of the tissue cultures were that of *Oxyporus nobilissimus*. However, *O.nobilissimus* has been reported to cause a brown rot because of the decay observed in the wood attached to the type specimen (Cooke, 1949). Our observations of wood in association with living specimens (whenever possible) also indicate brown rot. We are confident that *O.nobilissimus* causes a brown rot. The brown rot associated with the basidiomata is in contrast to that of the type species of *Oxyporus*, *Polyporus connatus* Weinm. [= *Polyporus populinus* Schum.:Fr., = *Oxyporus populinus* (Schum.:Fr.) Donk], which causes a white rot.

Besides the difference in rot characteristics, which are considered important at the generic level (*e.g.* Nobles, 1958; Donk, 1960; Ryvarden, 1991), *Oxyporus* (Bourd. & Galz.) Donk differs from *O.nobilissimus* in having true cystidia that arise from the subhymenium rather than pseudocystidia, which are differentiated hyphal end cells that arise in the trama. Species of *Rigidoporus* Murr. are similar to *O.nobilissimus* in possessing pseudocystidia, similar basidiospore and basidium shape and size, and both thin- and thick-walled generative hyphae, but it causes a white rot. *Rigidoporus* is probably the closest genus for placement of this species, but its members cause a white rot and lack the unique pileus surface hyphal structure of *O.nobilissimus*. Lowe (1955) placed *O.nobilissimus* in *Fomes* (Fr.) Fr. at a time when that genus encompassed a wide variety of large, conk-shaped species. It is no longer an appropriate placement since the concept of *Fomes* has been narrowed to include only trimitic species, with clamped generative hyphae and sclerids, and causing a white rot.

Other genera with simple-septate hyphae that we considered for placement of this species included *Physisporinus* Karst., but its members have resupinate, soft, waxy basidiomata and are associated with a white rot. *Pycnoporellus* Murr., em. Kotl. & Pouz., contains species that cause a brown rot and form bright orange to rust colored basidiomata that turn deep red in KOH. *Postia* Fr. (= *Oligoporus* Bref.) contains species whose members have clamp-connections on generative hyphae. In addition, the broadly ovoid basidiospore shape in *O.nobilissimus* is very different from known *Postia* species. None of the above genera contain species with the unique hyphal structure of hyphae on the pileus surface that is found in *O.nobilissimus*. Since no described genus is appropriate, we propose a new genus, *Bridgeoporus*, to accommodate this unique species.

Bridgeoporus* Volk, Burdsall & Ammirati *gen. nov. Figs. 1-8.
Basidiomatibus perennis, effusis-reflexis vel substipitatis, imbricatis, concrestis, suberosis, lignosis; pileis dense strigosis, fibris ramosis hispidis, zonatis; systemate hyphae monomitico, hyphis hyalinis, efibulatis; pseudocystidiis hyalinis; basidiosporis hyalinis, laevibus, nonamyloideis. Consociateus una cum tabes brunneo.

Etymology: *Bridgeoporus* m. Named for William Bridge Cooke (widely known as "Bridge"), who described *Oxyporus nobilissimus*.

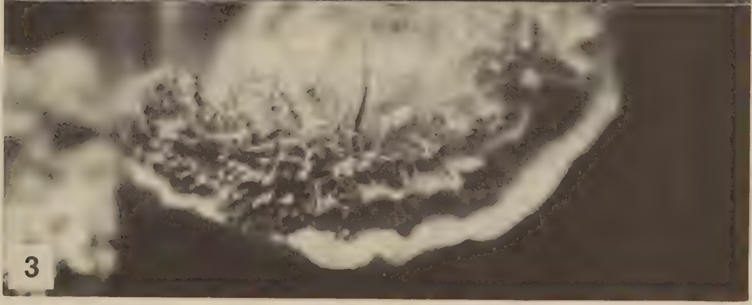
Type species: *Bridgeoporus nobilissimus* (W.B. Cooke) Volk, Burdsall, & Ammirati *comb. nov.*
basionym: *Oxyporus nobilissimus* W.B. Cooke, Mycologia 41: 444 (1949)
≡ *Fomes nobilissimus* (W.B. Cooke) Lowe, Mycologia 47:219 (1955)

Basidiomata perennial, 30-140 x 25-95 x 30-100 cm, sessile, ungulate, imbricate, or centrally substipitate, with the form depending on location on host tree (snag, stump, or living) (Fig. 1, 2) often occluding small twigs and other objects . Texture fibrous, rubbery and tough when fresh. Pileus surface (Fig. 3) a dense mat of white mycelial fibers in youth, often somewhat agglutinated at the tips, becoming cinnamon brown or darker in age and usually reaching several mm in length, often appearing green due to epiphytic association with several species of unicellular algae. Context up to 1.5 cm thick, white, tough, rubbery, and fibrous when fresh, cinnamon-buff to ochraceous, hard and brittle when dried. Pores concolorous with context, round, 2 per mm, 2-7 mm long in mature layers, not becoming stuffed, stratified, with a layer of sterile tissue 2-3 mm thick between successive pore layers.

Figs. 1-3. (opposite page) Macroscopic characters of *Bridgeoporus nobilissimus*. 1. Sessile form growing on the side of a snag. Note brown rotted wood behind the somewhat inconspicuous specimen in the center. 2. Centrally stipitate form growing on the ground from roots of a snag. 3. Closeup of pileus surface with coarse hairs. For information on how to obtain color computer images of these and other photographs of *B.nobilissimus* please contact T.Volk, whose current e-mail address is <tjvolk@facstaff.wisc.edu>

1

2


3

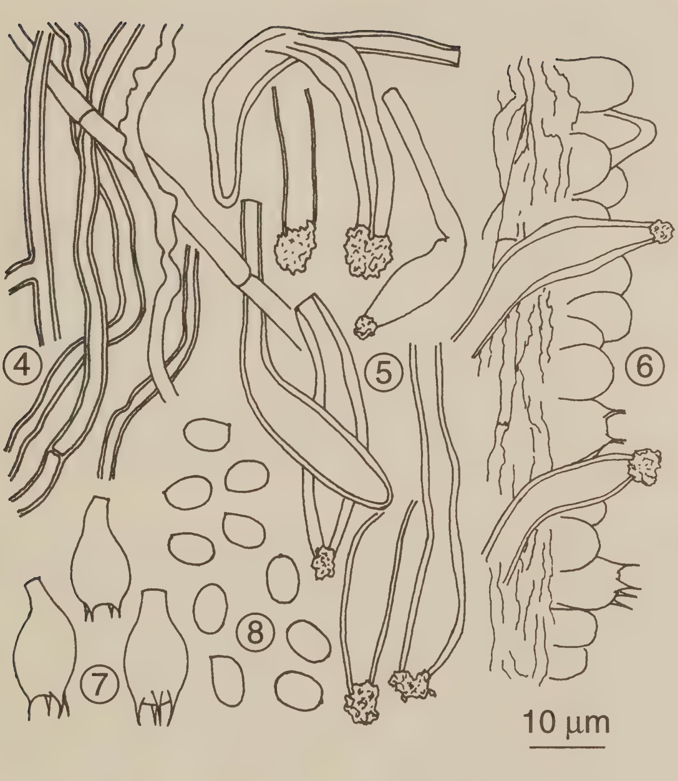
Fibers of the pileus surface 10-30 mm X (50)-60-75 μm, with frequent branching and anastomosing, showing layering as evidence of seasonally added increments of growth, new growth of the fibers occurring in discrete tufts of agglutinated hyphae scattered over the pileus surface, especially near the margin. The fibers are composed of bundles of simple-septate, parallel hyphae, 2-3 μm diam, hyaline to yellow-brown, simple-septate, thin- to slightly thick-walled, infrequently branching.

Context hyphae 3-4 μm diameter, thin-walled to thick-walled, simple-septate, hyaline to pale yellow-brown, smooth, rarely branched. Tramal hyphae like those of context, but some becoming thick walled and growing intrusively through the subhymenium, becoming pseudocystidia. Pseudocystidia up to 125 μm x 6-12 μm, cylindrical to broadly subulate, arising deep in the tramal tissue, evident before formation of basidia, walls slightly thickened or up to 4 μm thick in age, often with a hyaline, crystalline cap. Basidia 12-18 x 4-10 μm, pyriforme, 4-spored, simple-septate at base. Sterigmata 2-3 μm long. Basidiospores 5.5-6.5 x 3.5-4.5 μm, broadly ovoid, hyaline, smooth, thin-walled, negative in Melzer's reagent.

Habitat: Occurring singly or occasionally imbricate on old growth *Abies procera* (1-2 m or more diameter at breast height), rarely *Abies amabilis* or possibly *Tsuga heterophylla*. Position on the host is variable. It has been found near the root collar of living trees or snags, on sides of snags not far from the ground (1 m maximum height), and on old cut stumps, but not known to occur on downed logs.

Distribution: Known only from the Cascade Mountain Range in Washington and Oregon and the Coast Range on the Olympic Peninsula in Washington. Locations where basidiomata are found were given letter designations (*e.g.* AC, GM, LM, SP, HT, NR) based on their location. Number in parentheses following the location indicate number of basidiomata found at that site. Since these are perennial basidiomata of rarely-found fungi that are still extant, we decline to give exact locations in order to protect them.

Specimens examined: **A.H. Smith No. 31102**, holotype MICH, isotype WTU, Mt. Rainier National Park, WA, *Abies sp.*, 1948; **Extant basidiomata** (portions of which are at CFMR):, **AC** (3), King Co., Mt. Baker-Snoqualmie National Forest, WA, *A.procera*, 1992; **GM** (4) Cowlitz Co., Mt. St. Helens National Monument, WA, *A.procera*, 1992; **LM** (6) Multnomah Co., Mt. Hood National Forest, OR, *A.procera, T.heterophylla*, 1992, 1994; **SP** (15) Linn Co., Bureau of Land Management, OR, *A.procera*, 1991, 1992; **HT** (2) Olympic National Forest, Gray's Harbor Co., WA, *Abies amabilis*, 1992, 1993; **NR** (2) Mt. Rainier National Park, Pierce Co., WA, *A.procera*, 1992.



Figs. 4-8. Microscopic characters of *Bridgeoporus nobilissimus*. Fig. 4. Context hyphae. 5. Pseudocystidia. 6. Hymenium. 7. Basidia. 8. Basidiospores.

REMARKS: The type specimen was reported on *Tsuga heterophylla* (Cooke, 1949). However, microscopic examination of the wood attached to the base of the isotype is that of an *Abies* sp. (Regis Miller, Center for Wood Anatomy Research, Forest Products Lab, Personal Communication). This is consistent with the vast majority of specimen/host associations noted for *B. nobilissimus*. However one of the specimens in Multnomah County has been found at the base of a large *T. heterophylla* snag next to a large *Abies procera* snag. The host association of this specimen is unclear.

Cooke (1949) considered the fungus to have a dimitic hyphal system. Although thin-walled and thick-walled hyphae are present in the basidiomata, the latter should not be considered skeletal hyphae because of their abundant septa, but rather as sclerified generative hyphae. We concur with Gilbertson & Ryvarden (1987) who report *O. nobilissimus* as monomitic. Additional illustrations and descriptions of micro- and macroscopic characteristics can be found in Lowe (1955, 1957), Gilbertson & Ryvarden (1987), Coombs (1991) and Christy (1991).

The mat of mycelia on the upper surface is not solid, but very porous, containing cracks and crevasses that allow the accumulation of water and organic debris. Unicellular algae, including *Coccomyxa* sp. and *Charicium* spp., also occur. Our studies indicate that the algae appear to be living among fungal hyphae and not endophytically. In addition, some vascular plants (*e.g. Oxalis* sp. and pteridophytes) and bryophytes sometimes occur in and on the surface of the pileus.

As indicated in the description, a layer of external hyphae covers the previous year's pore surface before the initiation of a new pore layer. Each new layer arises from coalescence of discrete patches of mycelium formed external to the old pores. The pores begin as indentations on the layer of confluent sterile hyphae.

ACKNOWLEDGMENTS: We thank James Trappe, as well as Don H. Coombs and M. Maggie Rogers (the editors of **Mushroom, the Journal of Wild Mushrooming**) for renewing interest in this fungus. We thank Glenn Walker, James H. Ginns, David Shaw, Claire Hibler, Judy Roger, Lorelei Norvell, Elisabeth Eyestone, and Don and Bonnie Grandorff for help in finding and collecting specimens and putative cultures of this fungus. We thank Karen K. Nakasone, Rita M. Rentmeester and Kelly Collins for testing the identity of the cultures using PCR fingerprinting and DNA sequencing. We thank Linda and James Graham for identification of algal associates and Regis Miller for identification of host tree species. We thank Karen K. Nakasone and Michael J. Larsen for help with the Latin diagnosis. We thank Michael J. Larsen and Robert L. Gilbertson for review of the manuscript. We also thank Erast Parmasto, Leif Ryvarden, and Tuomo Niemelä for helpful discussions on the proper placement of this species.

LITERATURE CITED

Anonymous. 1994. Standards and Guidelines for management of habitat for late-successional and old-growth forest related species within the range of the northern spotted owl. Attachment A to the Record of decision for amendments to Forest Service and Bureau of Land Management planning documents within the range of the northern spotted owl. US Government Printing Office, Region 10.

Christy, J. 1991. The most noble polypore--- Endangered or already gone to passenger pigeon-land. Mushroom, the Journal of Wild Mushrooming **9(3)**:11

Cooke, W.B. 1949. *Oxyporus nobilissimus* and the genus *Oxyporus* in North America. Mycologia **41**:442-455.

Coombs, D.H., 1991. Looking for a big fuzzy one. Mushroom, the Journal of Wild Mushrooming **9** (4):5-8

Donk, M. 1960. The generic names proposed for Polyporaceae. Persoonia **1**:173-302.

Gilbertson, R.L. and L. Ryvarden. 1986. North American Polypores. Vol. 1 *Abortiporus-Lindtneria*. Oslo: Fungiflora. pp. 1-436.

Gilbertson, R.L. and L. Ryvarden. 1987. North American Polypores. Vol. 2. *Megasporoporia-Wrightoporia*. Oslo: Fungiflora. pp. 437-885.

Holmgren, P.K., N.H. Holmgren, and L.B. Barnett. 1990. **Index Herbariorum**. Eighth Edition. New York Botanical Garden. 693 pp.

Lizon, P. 1995. Preserving the biodiversity of fungi. Inoculum **46 (6)**: 1-4.

Lowe, J.L., 1955. Perennial polypores of North America III. *Fomes* with context white to rose. Mycologia **47**:213-224

Lowe, J.L., 1957. Polyporaceae of North America: The genus *Fomes*. State University College of Forestry at Syracuse University, Technical Publication No. 80. 97 pp.

Nakasone, K.K. and K.J. Sytsma. 1993. Biosystematic studies on *Phlebia acerina*, *P.rufa*, and *P.radiata* in North America. Mycologia **85**:996-1016.

Nobles, M.K. 1958. Cultural characters as a guide to the taxonomy and phylogeny of the Polyporaceae. Canad. J. Bot. **36**:883-926

Ridgway, R. 1912. Color Standards and Color Nomenclature. 53 plates.

Ryvarden L. 1991. Genera of Polypores: Nomenclature and Taxonomy. Fungiflora, Oslo, Norway. Synopsis Fungorum **5**. 363 pp.

Trappe, J.M. 1990. The "most noble" polypore endangered. *In* Ancient Forests of the Pacific Northwest. Elliot A Norse. The Wilderness Society. Island press. Washington DC pp. 126-127.

MYCOTAXON

Volume LX, pp. 397-414 October-December 1996

A CHECK LIST OF HIGHER MARINE FUNGI ON WOOD FROM DANISH COASTS

J. KOCH and K.R.L. PETERSEN

Department of Plant Biology, The Royal Veterinary and Agricultural University,
Thorvaldsensvej 40, DK-1871 Frederiksberg C, Denmark

Abstract

72 higher marine fungi on wood from the Danish coast are presented including 15 species as new records for Denmark. The fungi are listed from 12 localities on the west coast of Jutland and from 35 localities on the coasts of inner Danish waters. Comments are given on selected species. The list is based on 988 samples which are kept at the herbaria C and CP, Copenhagen.

Introduction

Generally, information on the occurrence of fungal species in a country or a greater area is difficult to obtain. As a rule, troublesome studies of literature and studies of material deposited in different herbaria are required. To remedy this the following check list for higher marine and arenicolous fungi on wood along the Danish coasts was prepared.

Materials and methods

The fungi are from driftwood deposited on beaches, from wood caught between stones functioning for coastal protection, and from stationary wood such as harbour timber. Some of the material was incubated with moist sterilized sand in plastic boxes for several months. The fungi are listed in table 2.

The material is divided into two groups, one from the west coast of Jutland and one from the inner Danish coast. This is due to the difference in salinity of the coastal waters in the two areas - at the west coast of Jutland the salinity is close to 3,1% and at the inner Danish coast between 1 and 2% (Hermann, 1968). Each locality has been given a number referring to the list of localities, table 1, and to the map, fig. 1.

In table 2 the quoted literature is referring to earlier published collections from Denmark. Where no literature is indicated the species is a new record for Denmark.

All collections mentioned have been studied by the authors. The study has been substantially faciliated by the keys prepared by Kohlmeyer & Volkmann-Kohlmeyer (1991).

The material, which consists of 988 samples, is kept at the herbarium (CP), The Royal Veterinary and Agricultural University, Copenhagen, and the Botanical Museum (C), University of Copenhagen.

Results and discussion

To some degree the number of collections give an impression of the frequency of occurrence of single species. However, a strict quantification cannot be read from table 2 as the collecting technique has not been adapted for this purpose. A grouping taking into account the number of collections of a species could roughly divide the fungi with regard to frequency into the following three groups, where the species in each group are arranged according to their frequency.

Frequency 1 (128-40 collections)
Monodictys pelagica, Arenariomyces trifurcatus, Nereiospora comata, Corollospora maritima, Halosphaeria appendiculata, Remispora stellata, R. maritima, Ceriosporopsis halima, Halosphaeriopsis mediosetigera, Ceriosporopsis tubulifera, Amylocarpus encephaloides, Lulworthia fucicola, Dictyosporium pelagicum, Zalerion maritimum, Dryosphaera navigans, Ocostaspora apilongissima, Marinospora calyptrata, Lulworthia lignoarenaria, Trichocladium alopallonella. - 19 species.

Frequency 2 (39-10 collections)
Remispora pilleata, Kohlmeyeriella tubulata, Nereiospora cristata, Carbosphaerella leptosphaerioides, Kirschsteinothelia maritima, Remispora galerita, Haligena elaterophora, Leptosphaeria oraemaris, Corollospora lacera, Digitatispora marina, Appendichordella amicta, Sphaerulina oraemaris, Cirrenalia macrocephala, Ceriosporopsis caduca, Groenhiella bivestia, Leptosphaeria pelagica, Carbosphaerella pleosporoides, Haligena salina, Anisostagma rotundatum, Limacospora sundica, Zalerion varium, Nia vibrissa, Orbimyces spectabilis, Marinospora longissima, Torpedospora ambispinosa. - 25 species.

Frequency 3 (9-1 collections)
Eiona tunicata, Halosarpheia viscosa, Marinosphaera mangrovei, Marisolaris ansata, Ondiniella torquata, Dictyosporium toruloides, Massarina thalassiae, Savoryella lignicola, Cumulospora marina, Halosarpheia trullifera, Nais inornata, Capronia ciliomaris, Biflua physasca, Bovicornua intricata, Nautosphaeria cristaminuta (fig. 10), *Asteromyces cruciatus, Trichocladium achrasporum, Biconiosporella corniculata, Diplodia oraemaris, Remispora quadriremis, Lautisporopsis circumvestita* (fig. 11), *Chaetomastia typhicola, Chaetosphaeria chaetosa, Corollospora luteola (+ Sigmoidea luteola), Lindra inflata, Remispora crispa, R. spinibarbata, Trichocladium constrictum.* - 28 species.

The general impression is that species with frequency 1 are common, which is in close agreement with findings by Schmidt (1974) at the coast of Rügen in the Baltic sea and by Schaumann (1975) in the Weser-Estuary and Helgoland at the North sea coast.

Species with frequency 3 are rare or very rare.

Most of the wood samples from the west coast of Jutland were collected as driftwood on the beaches. Together with the special beach characters (Koch, 1974) at the west coast, and the salinity of the coastal water, this could explain the prevalence of the arenicolous species *Corollospora lacera*, *Kohlmeyeriella tubulata* and *Nereiospora comata* in this area, and corresponding to that the general absence of the obligate marine species *Halosphaeria appendiculata*, *Lulworthia fucicola* and *Marinospora calyptrata*.

Schaumann (1975) states that "Ascomycetes dominate in the more saline habitats with the Deuteromycetes predominantly in the lower saline and more limnetic parts of the estuary". Concerning the Deuteromycetes, this also seems to be the case, when comparing material from the west coast of Jutland with material from the inner Danish coasts. Especially dominant here are *Cirrenalia macrocephala*, *Dictyosporium pelagicum*, *Monodictys pelagica* and *Trichocladium alopallonella*. The same trend was found by Schmidt (1974).

The following 15 species are new records for Denmark: *Biconiosporella corniculata, Capronia ciliomaris, Chaetomastia typhicola, Corollospora luteola (+ Sigmoidea luteola), Haligena salina, Leptosphaeria pelagica, Marinosphaera mangrovei, Marinospora longissima, Massarina thalassiae, Ondiniella torquata* (fig. 9), *Remispora crispa, Sphaerulina oraemaris, Torpedospora ambispinosa, Cumulospora marina, Trichocladium constrictum.*

Comments on single species

Capronia ciliomaris. This species is considered exclusively as growing on bark (fig. 3), but one collection here is from heavily decayed wood. We have not been able to observe the subterminal, radiating filamentous appendages of the ascospores. We have only seen mucus fibrils surrounding the spores (fig. 4). This also apply to spores from the type material (J. Kohlmeyer 226, 253 in Herb. Mus. Bot. Berol.). In all the aspects, the type material conforms with our collections.

Ceriosporopsis caduca. By Koch (1974) wrongly cited sub nomen *C. longissima* Kohlm. and by Koch & Jones (1983) sub nomen *C. cambrensis* I.M. Wilson. In the Danish material of *C. caduca*, we have not observed the shedding of the outer sheath from the polar appendages as mentioned by Jones & Zainal (1988), but catenophyses and filamentous catenophyses are abundant.

Chaetomastia typhicola. We record this species with hesitation since it has been described from *Typha*, *Juncus* and *Phragmites* and not from wood. Microscopic characters are in agreement with Kohlmeyer & Kohlmeyer (1979) who consider the species a facultative marine fungus.

Dictyosporium toruloides. This species is considered a facultative marine fungus. We have found it on intertidal wood and on a mooring post of oak in Svanemøllen Harbour (39) 60 cm below daily water. Ellis (1971) wrote "Common on wood and herbaceous stems" indicating it as a terrestrial species.

Dryosphaera navigans. Early records (Farrant et al. 1985, Koch, 1974, 1985, and Koch & Jones, 1983) of this species were given sub nomen *Crinigera maritima* I. Schmidt (see Koch & Jones, 1989).

Halosarpheia viscosa. In the quoted collections the ascospores are mostly separated from the ascomata in masses without showing asci, but when seen, they are thinwalled. The ascospore dimensions are also close to *Ceriosporopsis hamata* Höhnk and *Halosarpheia retorquens* Shearer et Crane. We have therefore not been able to assign our collections with confidence to any of the mentioned taxa. We consider the collections as *H. viscosa*, *sensu lato*.

Also we have 8 collections with *Halosarpheia* spores (thinwalled), showing persistent *Aniptodera*-like asci. We have found no genus to accomodate this species.

Marinosphaera mangrovei. Since this species is mainly reported from tropical zones, we have compared (LM) our collections with the type material. This was found to conform with our fungus. Ascospores from a Danish collection (figs 5-7) showed, that they were covered by a fibrillar material (fig. 2) as shown by Read et al. (1995).

Marinospora longissima. See comments relating to *Ceriosporopsis caduca*.

Massarina thalassiae. This species is common on oak in the intertidal zone at Strandegaard Dyrehave (44), but has not been found on oak or other wood substrates in similar positions from any Danish localities. The species is described by Kohlmeyer & Volkmann-Kohlmeyer (1987) on different wood substrates from the tropics. With regard to ascospore dimension the Danish collections are very close (30-36,4-40 x 10-11,9-12 µm, n=31) to dimension given by Kohlmeyer & Volkmann-Kohlmeyer (1987) (31,0-37,8-43,5(-47,1) x 9,7-12,2-14,1 µm, n=215). Asci measured *in situ* conform with measurements by Kohlmeyer & Volkmann-Kohlmeyer (1987). *M. thalassiae* has not been recorded before in the temperate zone (fig. 8).

Ocostaspora apilongissima. In Koch (1974) as a variety of *Halosphaeria appendiculata*.

Remispora crispa. This is the first record of the species outside the tropical region. It was found on a mooring post of oak in Svanemøllen Harbour (39), where the harbour bassin for many years was kept free of ice because of outlet of cooling water from an electricity plant. Nevertheless it is with some hesitation we list this species.

Remispora galerita. In Koch (1974) sub nomen *Lentescospora submarina* Linder.

Table 1. List of Danish localities. 1-12 west coast of Jutland, 13-47 coast of inner Danish waters. See fig. 1 and table 2.

Number/Locality
1. Tannishus
2. Grønhøj
3. Svinkløv
4. Hjardemål
5. Vigsø
6. Hanstholm
7. Stenbjerg
8. Lyngby
9. Fjaltring
10. Husby
11. Årgab
12. Rømø
13. Bygholm
14. Glyngøre
15. Skive
16. Hals Færgeleje

Number/Locality
17. Havhuse
18. Sønderskov
19. Skovgaarde
20. Helgenæs
21. Staksrode Skov
22. Varbjerg Strand
23. Æbelø
24. Tørresø
25. Langø
26. Lerchenborg
27. Hundested
28. Liseleje
29. Tisvildeleje
30. Rågeleje
31. Hornbæk
32. Helsingør

Number/Locality
33. Nivå
34. Rungsted
35. Vedbæk
36. Skodsborg
37. Tårbæk
38. Skovshoved
39. Svanemøllen Havn
40. Saltholm
41. Køge
42. Stevns Klint (Højerup)
43. Højstrup
44. Strandegård Dyrehave
45. Lilleklint
46. Marrebæk
47. Bøtø

Fig. 1. Map of Denmark showing localities for collecting lignicolous and arenicolous marine fungi. See list of localities table 1.

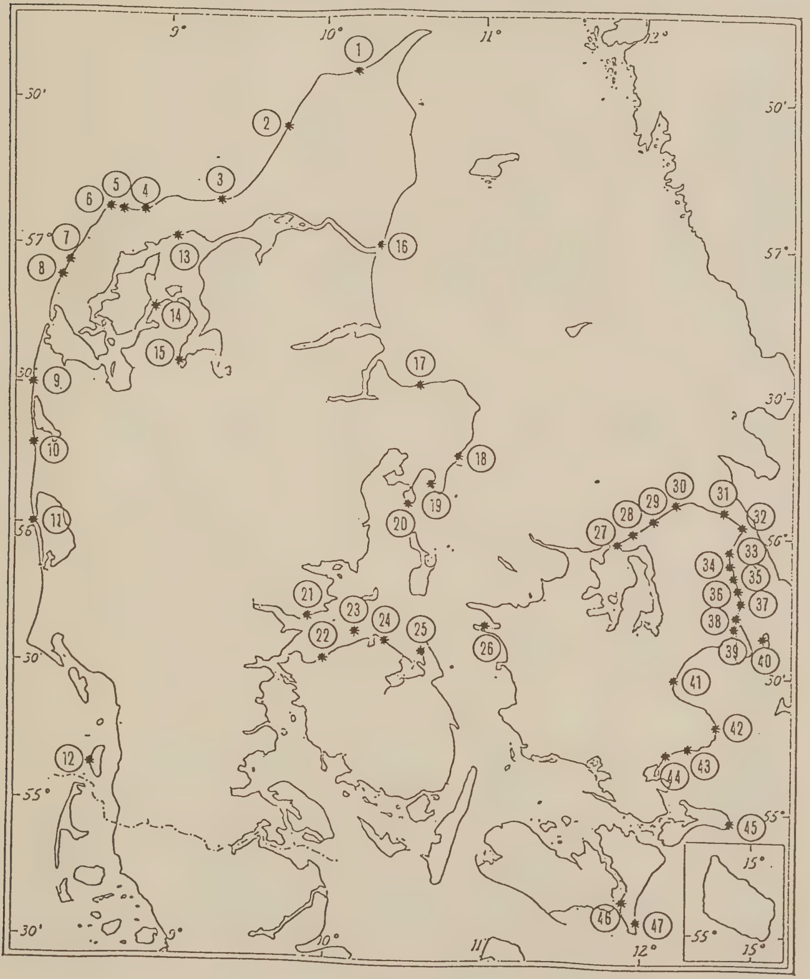

9°
10°
11°
12°
30'
57°
30'
56°
30'
55°
30'
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
15°
55°
15°

Table 2. Collections of marine fungi on wood from Danish coasts. All collections have been studied by the authors and are contained in the herbaria CP and C, Copenhagen. Species marked with an asterix are commented in the text. Localities, see list of localities (table 1) and the map (fig. 1). The literature quoted deal with Danish collections.

The fungi	**Number of collections**			**Localities**	**Literature**
	West coast of Jutland	**Coasts of inner Danish waters**	**Total**		
Ascomycotina					
Amylocarpus encephaloides Curr. - Proc.R.Soc.Lond. 9: 119-123, 1857/59	26	24	50	1, 2, 12, 14, 15, 18, 22, 35-37, 39, 43-45	b, e, g, i, k, l, n, r, t, u, v, x
Anisostagma rotundatum K.R.L. Petersen et Jørgen Koch - Myc.Res., 1996	0	15	15	39	s
Appendichordella amicta (Kohlm.) R.G. Johnson, E.B.G. Jones et S.T. Moss - Can.J.Bot. 65: 941, 1987	5	17	22	2, 5, 14, 15, 18, 22, 23, 30, 32, 35, 36, 44	b, g, i, k, t
Arenariomyces trifurcatus Höhnk - Veröff.Inst.Meeresforsch.Bremerhaven 3: 30, 1954	27	95	122	2, 4-6, 10, 14, 15, 17-20, 22, 24, 25, 29, 30, 32-36, 41, 42, 44, 46, 47	b, g, h, i, j, l, n, t, u, æ
Biconiosporella corniculata Schaumann - Veröff.Inst.Meeresforsch. Bremerhaven 14: 24-25, 1972	0	3	3	21, 39, 44	

Biflua physasca Jørgen Koch et E.B.G. Jones - Can.J.Bot. 67: 1183, 1989	0	4	4	14, 30, 32	l
Bovicornua intricata Jørgen Koch et E.B.G. Jones - Can.J.Bot. 71: 346-352, 1993	3	1	4	2, 7, 23	æ
**Capronia ciliomaris* (Kohlm.) E. Müll., Petrini, P.J. Fisher, Samuels et Rossman - Trans.Brit.Mycol.Soc. 88: 73, 1987	0	5	5	14, 15, 39, 44	
Carbosphaerella leptospharioides I. Schmidt - Nat.Naturschutz Mecklenburg 7: 9-10, 1969	22	8	30	2, 5, 30, 35, 44	b, g, i, j, t
Carbosphaerella pleosporoides I. Schmidt - Feddes Repert. 80: 108, 1969	2	15	17	2, 18, 22, 24, 30, 41, 44	h
**Ceriosporopsis caduca* E.B.G. Jones et Zainal - Mycotaxon 32: 327, 1988	12	7	19	2, 5, 10, 30, 31, 35, 36, 38	g, i
Ceriosporopsis halima Linder - Farlowia 1: 409, 1944	21	48	69	2, 5, 10, 14, 15, 18, 22, 28, 31, 32, 35-38, 40, 41, 44, 46, 47	b, g, i, l, n, t, æ
Ceriosporopsis tubulifera (Kohlm.) P.W. Kirk - Can.J.Bot. 50: 1953, 1972	11	44	55	2, 14, 15, 18, 22, 23, 24, 30, 31, 32, 34-36, 41, 44, 46, 47	b, g, i, k, t, æ

Table 2, continued

**Chaetomastia typhicola* (P. Karst.) M.E. Barr - Mycotaxon 34: 514, 1989	0	0	1	44	
Chaetosphaeria chaetosa Kohlm. - Nova Hedwigia 6: 307-308, 1963	1	0	1	2	g, i
Corollospora lacera (Linder) Kohlm. - Ber.Dtsch.Bot.Ges. 75: 126, 1962	26	1	27	2, 5, 6, 8, 9, 10	b, g, i, f, n, t
Corollospora luteola Nakagiri et Tubaki - Trans.Mycol.Soc.Jpn. 23: 102-103, 1982	0	1	1	38	
Corollospora maritima Werderm. - Notizbl.Bot.Gart.u.Mus.Berlin-Dahlem 8: 248, 1922	50	49	99	2, 4-6, 8, 10, 14, 15, 18, 22, 24, 25, 29-32, 34, 35, 44, 46, 47	b, g, i, j, n, t, u
**Dryosphaera navigans* Jørgen Koch et E.B.G. Jones - Can.J.Bot. 67: 1185, 1989	21	25	46	2, 5, 8, 15, 18, 19, 22, 30, 32, 47	b, e, g, i, j, l, t
Eiona tunicata Kohlm. - Ber.Dtsch.Bot. Ges. 81: 58, 1968	9	0	9	2, 5	b, e, g, i, l, n, t, u
Groenhiella bivestia Jørgen Koch, E.B.G. Jones et S.T. Moss - Bot.Mar. 26: 265-266	15	4	19	2, 5, 39, 44, 46	b, m

Haligena elaterophora Kohlm. - Nova Hedwigia 3: 87-88, 1961	6	22	28	2, 5, 10, 14, 24, 25, 29, 31, 32, 34-36, 38, 39, 42	b, g, i, n, t
Haligena salina C.A. Farrant et E.B.G. Jones - Bot.J. Linn. Soc. 93: 406, 1986	0	17	17	21, 39, 44	
Halosarpheia trullifera (Kohlm.) E.B.G. Jones, S.T. Moss et Cuomo - Trans.Brit.Mycol.Soc. 80: 200, 1983	0	6	6	39	g
**Halosarpheia viscosa* (I. Schmidt) Kohlm. et Volkm.-Kohlm. *sensu lato* - Mycotaxon 24: 420, 1985	0	9	9	15, 22, 24, 30, 33, 34, 36, 44	g, i
Halosphaeria appendiculata Linder - Farlowia 1: 412, 1944	7	92	99	2, 5, 7, 10, 11, 14-16, 18, 19, 22-24, 31-40, 44, 46, 47	g, i, k, n, æ
Halosphaeriopsis mediosetigera (Cribb et J.W. Cribb) T.W. Johnson - J.Elisha Mitchell Sci.Soc. 74: 44, 1958	10	48	58	2, 10, 14-16, 18, 20 22-24, 27, 30, 34, 35 37, 39, 41, 44, 47	b, g, i, s, t
Kirschsteiniothelia maritima (Linder) D. Hawksw. - Bot.J.Linn.Soc. 91: 193, 1985	7	23	30	2, 11, 14, 30, 31, 34-39	b, i
Kohlmeyeriella tubulata (Kohlm.) E.B.G. Jones, R.G. Johnson et S.T. Moss - Bot.J.Linn.Soc. 87: 210, 1983	37	0	37	2, 5, 6, 8, 10	b, g, i, j, n, t, u

Table 2, continued

Lautisporopsis circumvestita (Kohlm.) M. Yusoff, E.B.G. Jones et S.T. Moss - Can.J.Bot 72: 1550-1559, 1995	1	0	1	11	b
Leptosphaeria oraemaris Linder - Farlowia 1: 413, 1944	7	21	28	2, 5, 16, 22, 35, 36, 39, 44	b, g, i, s, t
Leptosphaeria pelagica E.B.G. Jones - Trans.Brit.Mycol.Soc. 45: 105, 1962	3	16	19	2, 15, 22, 25, 35-37, 39, 44	
Limacospora sundica (Jørgen Koch et E.B.G. Jones) Jørgen Koch et E.B.G. Jones - Can.J.Bot. 73: 1011-1014, 1995	0	13	13	18, 30, 35, 36	f, k
Lindra inflata I.M. Wilson - Trans. Brit.Mycol.Soc. 39: 411, 1956	1	0	1	2	b, g, i, t
Lulworthia fucicola G.K. Sutherl. - Trans.Brit.Mycol.Soc. 5: 259, 1916	2	48	50	2, 16, 18, 23-25, 29, 30, 32, 35, 37, 39, 44	b, g, i, j, l, s, t
Lulworthia lignoarenaria Jørgen Koch et E.B.G. Jones - Mycotaxon 20: 389, 1984	30	10	40	2, 5, 8, 29, 30, 32, 44	b, j
**Marinosphaera mangrovei* K.D. Hyde - Can.J.Bot. 67: 3080, 1989	0	9	9	23, 39, 44	

Marinospora calyptrata (Kohlm.) A.R. Caval. - Nova Hedwigia 11: 548, 1966	0	45	45	2, 16, 18, 22, 23, 34-36, 39, 44	g, i, k
**Marinospora longissima* (Kohlm.) A.R. Caval. - Nova Hedwigia 11: 548, 1966	0	11	11	39, 44	
Marisolaris ansata Jørgen Koch et E.B.G. Jones - Can.J.Bot. 67: 1183, 1989	0	9	9	15, 19, 30, 32, 44	l
**Massarina thalassiae* Kohlm. et Volkm.-Kohlm. - Can.J.Bot. 65: 575, 1987	0	7	7	44	
Nais inornata Kohlm. - Nova Hedwigia 4: 409, 1962	0	6	6	34-36	b, t
Nautosphaeria cristaminuta E.B.G. Jones - Trans.Brit.Mycol.Soc. 47: 97, 1964	2	2	4	2, 11, 18	b, g, i, t
Nereiospora comata (Kohlm.) E.B.G. Jones, R.G. Johnson et S.T. Moss - Bot.J.Linn.Soc. 87: 206, 1983	89	19	108	2-6, 8-10, 12, 14, 17, 19, 24, 30, 32, 34-36, 38, 41, 42, 44	b, g, i, j, l, n, t, u
Nereiospora cristata (Kohlm.) E.B.G. Jones, R.G. Johnson et S.T. Moss - Bot.J.Linn.Soc. 87: 206, 1983	2	29	31	2, 14, 15, 19, 22, 25, 30, 32, 35, 36, 39, 44, 47	b, g, i, n, t

Table 2, continued

**Ocostaspora apilongissima* E.B.G. Jones, R.G. Johnson et S.T. Moss - Bot.Mar. 26: 354, 1983	14	32	46	2, 14, 15, 18, 22, 23, 30, 32, 35, 39, 44	b, g, l
Ondiniella torquata (Kohlm.) E.B.G. Jones, R.G. Johnson et S.T. Moss - Bot.Mar. 27: 136, 1984	0	9	9	39	
**Remispora crispa* Kohlm. - Can.J.Bot. 59: 1317, 1981	0	1	1	39	
**Remispora galerita* Tubaki - Publ. Seto Mar.Biol.Lab. 15: 362, 1968	3	26	29	2, 10, 14, 15, 18, 22, 32, 36, 40, 44, 47	g, i, æ
Remispora maritima Linder - Farlowia 1: 410, 1944	17	71	88	2, 5, 7, 8, 10, 11, 14-16, 18-25, 29-32, 34-39, 44, 46, 47	b, g, h, i, t
Remispora pilleata Kohlm. - Nova Hedwigia 6: 319, 1963	22	16	38	2, 5, 6, 12, 14, 24, 31, 34-36, 38-40	b, g, i, n, t
Remispora quadriremis (Höhnk) Kohlm. - Nova Hedwigia 2: 332, 1960	0	2	2	14, 32	d, i, l, n
Remispora spinibarbata Jørgen Koch - Nordic J.Bot. 8: 517, 1989	0	1	1	30	h

Remispora stellata Kohlm. - Nova Hedwigia 2: 334, 1960	54	41	95	2, 4, 5, 14, 17, 24, 25, 30, 31, 34-36, 38-42, 44	b, g, h, i, l, t
Savoryella lignicola E.B.G. Jones et R.A. Eaton - Trans.Brit.Mycol. Soc. 52: 162, 1969	0	7	7	44	
Sphaerulina oraemaris Linder - Farlowia 1: 413, 1944	1	21	22	2, 18, 22, 39, 44	
Torpedospora ambispinosa Kohlm. - Nova Hedwigia 2: 336, 1960	1	9	10	2, 29, 30	
Deuteromycotina					
Asteromyces cruciatus Moreau et M. Moreau - Can.J.Bot. 40: 1213, 1962	2	1	3	2, 30	i, t, u
Cirrenalia macrocephala (Kohlm.) Meyers et R.T. Moore - Am.J.Bot. 47: 347, 1960	0	20	20	13, 14, 28, 33-35, 39, 41	i, t
Cumulospora marina I.Schmidt - Mycotaxon 24: 420, 1985	0	6	6	35, 39	
Dictyosporium pelagicum (Linder) G.C. Hughes - Fungi in Oceans and Estuaries, Cramer, p. 391, 1961	7	42	49	2, 5, 6, 11, 14, 22, 25, 29, 30, 32, 34-36, 38, 39, 41, 42, 46	i, t

Table 2, continued

**Dictyosporium toruloides* (Corda) Gueguen - Bull. trimest. Soc. mycol. Fr. 21: 101, 1905	2	5	7	2, 5, 35, 39, 44	l
Diplodia oraemaris Linder - Farlowia 1: 403, 1944	2	0	2	2	i
Monodictys pelagica (T.W. Johnson) E.B.G. Jones - Trans.Brit.Mycol. Soc. 46: 138, 1963	30	98	128	2, 4-6, 10, 14, 15, 17-25, 29, 30, 32-38, 42, 44, 46, 47	b, g, i, l, s, t, u
Orbimyces spectabilis Linder - Farlowia 1: 404-405, 1944	1	11	12	2, 30, 32, 39, 44	b, i
Sigmoidea luteola Nakagiri et Tubaki - Trans.Mycol.Soc.Jpn. 23: 102-103, 1982	0	1	1	44	
Trichocladium achrasporum Meyers et R.T. Moore - Mycologia 63: 244, 1971	1	2	3	2, 39	i
Trichocladium alopallonellum (Meyers et R.T. Moore) Kohlm. et Volkm.-Kohlm. - Mycotaxon 53: 352, 1995	6	34	40	2, 10, 14-17, 24, 31, 32, 35, 38, 39, 41, 44, 46, 47,	i, l, t

Trichocladium constrictum I. Schmidt - Mycotaxon 24: 420, 1985	0	1	1	41	
Zalerion maritimum (Linder) Anastasiou - Can.J.Bot. 41: 1136, 1963	10	39	49	2, 5, 11, 14-16, 22, 25, 32, 34-39	b, g, i, t, u
Zalerion varium Anastasiou - Can.J.Bot. 41: 1136, 1963	0	13	13	14, 19, 22, 29, 32, 35, 46, 47	i, l, t
Basidiomycotina					
Digitatispora marina Doguet - C.R. Hebd. Seances Acad.Sci. 254: 4338, 1962	3	21	24	2, 5, 23, 24, 32, 35-38, 44	g, i, k
Nia vibrissa R.T. Moore et Meyers - Mycologia 51: 874, 1959	6	6	12	2, 15, 35, 36	b, g, i, k, t

Acknowledgement

The authors wish to thank Professor E.B. Gareth Jones, University of Portsmouth, for reviewing the manuscript. The senior author express his gratitude to E.B. Gareth Jones for his agelong interest and support in the study of marine lignicolous fungi from the Danish coast. An interest and support without which this work would not have been possible.

Literature

a. Ellis, M.B. (1971). Dematiaceous Hyphomycetes. CMI, Kew, 608p.
b. Farrant, C., Hyde, K.D. & Jones, E.B.G. (1985). Further studies on lignicolous marine fungi from Danish sand dunes. Transactions of the British Mycological Society. 85: 164-167.
c. Hermann, F. (1968). Danmarks Natur (havet) - Hydrografi. Politikens Forlag, København. 3: 24-47.
d. Höhnk, W. (1955). Studien zur Brack- und Seewassermykologie V. Höhere Pilze des submersen Holzes. Veröffentlichungen des Instituts für Meeresforschung in Bremerhaven. 3: 199-227.
e. Johnson, R.G., Jones, E.B.G. & Moss, S.T. (1991). Histochemical and electron microscope studies of ascospore ontogeny in three marine fungi with cleistothecia: *Amylocarpus encephaloides* Curry, *Dryosphaera navigans* Koch et Jones and *Eiona tunicata* Kohlm. Botanica Marina. 34: 229-239.
f. Jones, E.B.G., Koch, J. & Moss, S.T. (1995). *Limacospora* gen.nov. and a re-evaluation of *Ceriosporopsis cambrensis*. Canadian Journal of Botany. 73: 1011-1014.
g. Koch, J. (1974). Marine fungi on driftwood from the west coast of Jutland, Denmark. Friesia. 10: 209-250.
h. Koch, J. (1989). *Remispora spinibarbata* sp. nov., a marine lignicolous ascomycete from Denmark. Nordic Journal of Botany. 8: 517-520.
i. Koch, J. & Jones, E.B.G. (1983). Vedboende havsvampe fra danske kyster. Svampe. 8: 49-65.
j. Koch, J. & Jones, E.B.G. (1984). *Lulworthia lignoarenaria*, a new marine pyrenomycete from coastal sands. Mycotaxon. 20: 389-395.
k. Koch, J. & Jones, E.B.G. (1986). *Ceriosporopsis sundica*, a new lignicolous marine ascomycete from Denmark. Nordic Journal of Botany. 6: 339-344.
l. Koch, J. & Jones, E.B.G. (1989). The identity of *Crinigera maritima* and three new genera of marine cleistothecial ascomycetes. Canadian Journal of Botany. 67: 1183-1197.
m. Koch, J., Jones, E.B.G. & Moss, S.T. (1983). *Groenhiella bivestia*, gen. et sp. nov., a lignicolous marine fungus from Denmark. Botanica Marina. 26: 265-270.
n. Kohlmeyer, J. (1968). Dänische Meerespilze (Ascomycetes). Berichten der Deutschen Botanische Gesellschaft. 81: 53-61.
o. Kohlmeyer, J. & Kohlmeyer, E. (1979). Marine Mycology. The higher fungi. Academic Press, New York, 690p.
p. Kohlmeyer, J. & Volkmann-Kohlmeyer, B. (1987). Marine fungi from Aldabra, the Galapagos, and other tropical islands. Canadian Journal of Botany. 65: 571-582.
q. Kohlmeyer, J. & Volkmann-Kohlmeyer, B. (1991). Ilustrated key to the filamentous higher marine fungi. Botanica Marina. 34: 1-61.

r. Lind, J. (1913). Danish fungi as represented in the herbarium of E. Rostrup. Gyldendalske Boghandel-Nordisk Forlag, Copenhagen. 659 pp.

s. Petersen, K.R.L. & Koch, J. (1996). *Anisostagma rotundatum* gen. et sp. nov., a lignicolous marine ascomycete from Svanemøllen Harbour in Denmark. Mycological Research.

ss. Read, S.J., Jones, E.B.G., Moss, S.T. & Hyde, K.D. (1995). Ultrastructure of asci and ascospores of two mangrove fungi: *Swampomyces armeniacus* and *Marinosphaera mangrovei*. Mycological Research. 99: 1465-1471.

t. Rees, G., Johnson, R.G. & Jones, E.B.G. (1979). Lignicolous marine fungi from Danish sand dunes. Transactions of the British Mycological Society. 72: 99-106.

u. Rees, G. & Jones, E.B.G. (1985). The fungi of a coastal sand dune system. Botanica Marina. 28: 213-220.

v. Rostrup, E. (1884). Underjordiske svampe i Danmark. Meddelelser fra den botaniske Forening. 1: 102-106.

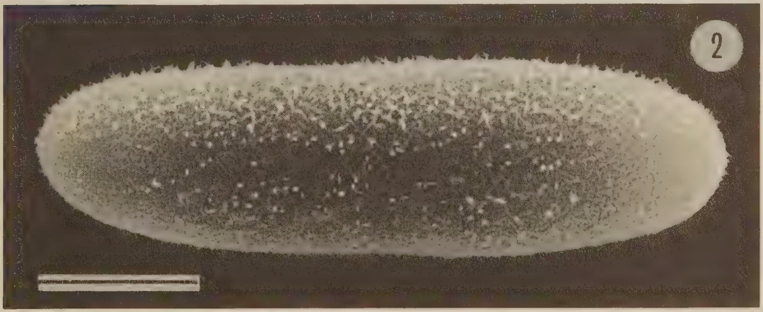
x. Rostrup, E. (1888). Mykologiske Meddelelser. Meddelelser fra den botaniske Forening. 2: 84-93.

y. Schaumann, K. (1975). Ökologische Untersuchungen über höhere Pilze im Meer -und Brackwasser der Deutschen Bucht unter besondere Berücksichtigung der holzbesiedelen Arten. Veröffentlichungen des Instituts für Meeresforschung in Bremerhaven. 15: 79-182.

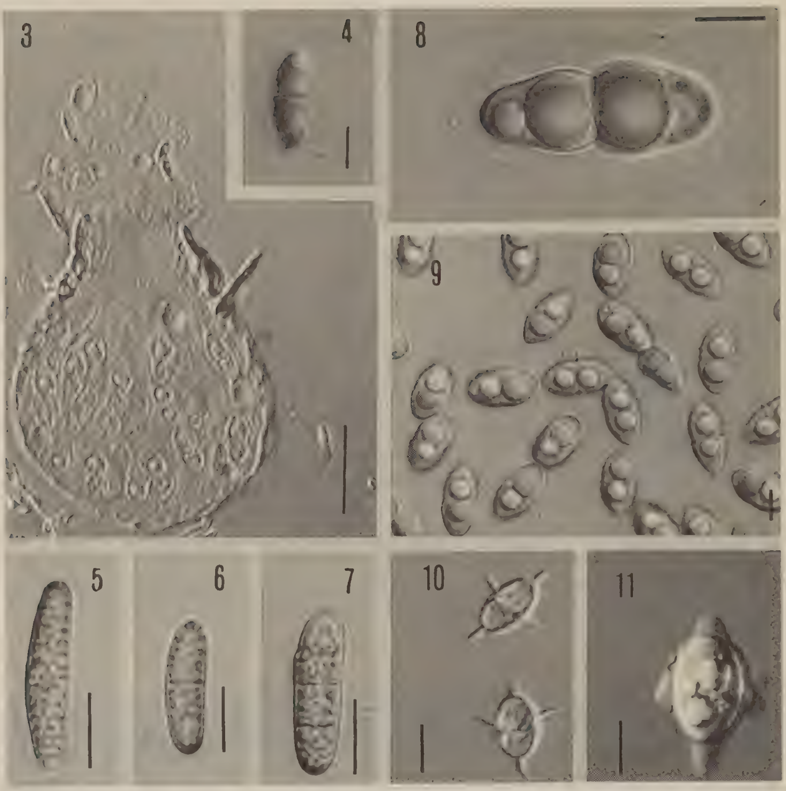
z. Schmidt, I. (1974). Untersuchungen über höhere Meerespilze an der Ostseeküste der DDR. - Natur und Naturschutz in Mecklenburg. 12: 1-148.

zz. Yusoff, M., Jones, E.B.G. & Moss, S.T. (1995). A reappraisal of the taxonomy of the genus *Ceriosporopsis* Linder based on their ultrastructure. Canandian Journal of Botany. 72: 1550-1559.

æ. Yosoff, M., Koch, J., Jones, E.B.G. & Moss, S.T. (1993). Ultrastructural observations on a marine lignicolous ascomycete: *Bovicornua intricata* gen. et sp. nov. Canadian Journal of Botany. 71: 346-352.



SEM micrograph. **Fig. 2**. *Marinosphaera mangrovei*. Ascospore covered by a layer of fibrillar material (after 15 min settlement on the membrane). Scale bar = 5 μm.



Light micrographs. **Figs 3, 4**. *Capronia ciliomaris*. **Fig. 3**. Ascoma with a membraneous peridium. **Fig. 4**. Ascospore surrounded by radiating appendages forming knots at the tips. **Figs 5-7**. *Marinosphaera mangrovei*. Ascospores. **Fig. 8**. *Massarina thallasiae*. Ascospore enclosed in a mucilaginous sheath. **Fig. 9**. *Ondiniella torquata*. Ascospores with polar rigid appendages and a tubular annulus around the septum. **Fig. 10**. *Nautosphaeria cristaminuta*. Ascospores with polar and equatorial appendages. **Fig. 11**. *Lautisporopsis circumvestita*. Ascospore covered by an irregular mucilaginous sheath, protuding at the poles and around the septum. Scale bars: Fig. 3 = 50 μm; figs 4-11 = 10 μm.

MYCOTAXON

Volume LX, pp. 415-428 October-December 1996

LICHENICOLOUS FUNGI FROM THE WESTERN PYRENEES, FRANCE AND SPAIN.
II. MORE DEUTEROMYCETES

Javier ETAYO
Navarro Villoslada, 16, 3º dcha
E-31003 Pamplona, Spain

Paul DIEDERICH
Musée national d'histoire naturelle
Marché-aux-Poissons
L-2345 Luxembourg, Luxembourg

Abstract: 12 species of lichenicolous deuteromycetes are recorded from the western Pyrenees. 4 species are described as new: *Hainesia pertusariae* Etayo & Diederich (on *Pertusaria* sp.), *Macrophomina pseudeverniae* Etayo & Diederich (on *Pseudevernia furfuracea*), *Milospium lacoizquetae* Etayo & Diederich (on *Cladonia parasitica*) and *Sclerococcum parmeliae* Etayo & Diederich (on *Parmelia* s. l.). The genus *Marchandiomyces* is recognized to include at least two species: *M. corallinus* (Roberge) Diederich & D. Hawksw. with pinkish, initially immersed conidiomata, and *M. aurantiacus* (Lasch) Diederich & Etayo comb. nov., with orange, more or less superficial conidiomata.

Introduction

This paper represents the second of our series dealing with lichenicolous fungi from the western Pyrenees. Like the first part (Etayo & Diederich 1995), we study here a number of lichenicolous deuteromycetes.

Material and Methods

Most specimens studied are located in the private herbaria of the authors, type specimens in K, M, MA-Lichen and UPS. Microscopical examination of herbarium material has been done at a magnification of x1000, measurements in water, and illustrations in water or Congo-red.

Results and Discussion

Ampullifera foliicola Deight.

France: Pyrénées-Atlantiques, S of Tardets-Sorholus, Gorges de Kakouetta, on *Byssoloma subdiscordans* (Nyl.) P. James, 26 July 1990, *P. Diederich* 9462; *ibid.*, on *B. leucoblepharum* (Nyl.) Vainio, 31 Jan. 1993, *J. Etayo* 12169. - *Spain*: Catalunya, Girona, Oix, Riera d'Oix, 500 m, on *B. subdiscordans*, Febr. 1991, *J. Etayo* 5726; Guipúzcoa, Jaizkibel, on *B. leucoblepharum*, 15 Nov. 1991, *J. Etayo* 6249; Navarra, E of Lumbier, Foz de Arbayún, on *B. subdiscordans*, 21 July 1991, *J. Etayo* 5120; *ibid.*, 7 May 1987, *J. Etayo* s. n.

Hawksworth (1979) reported this species from Brazil and Ghana on foliicolous lichens. The exsiccata Santesson *Fungi Lich. Exs.* 51 represents material from Madeira on *Byssoloma subdiscordans*. Sérusiaux (in press) mentions its presence on *Byssoloma subdiscordans* in Madeira and in the French Pyrenees. The fungus seems to be not rare in regions where *Byssoloma* species exist.

Bachmanniomyces uncialicola (Zopf) D. Hawksw.

Spain: Navarra, Urroz de Santesteban, pantano de Leurtza, 900 m, on *Cladonia furcata* (Huds.) Schrader, 13 Febr. 1994, *J. Etayo* 12173.

Hawksworth (1981) recognized this species as a parasymbiont on the *Cladonia uncialis* (L.) Weber group, but mentioned a few doubtful literature records on other species of *Cladonia*. This is the first record on *Cladonia furcata* and also the first record of the species from Spain.

Fusarium peltigerae Westend. & Wallys

Spain: Navarra, Baztán Valley, between Errazu and Izpegui, on *Parmeliella testacea* P. M. Jørg., 440 m, 6 March 1994, *J. Etayo* 12227.

Our specimen fits well the description of this species given by Hawksworth (1979). It forms pinkish to orange sporodochia, slimy when wet and irregular when dry. Conidiogenous cells are 17-27 x 2.5-3 µm, conidia curved or straight, hyaline, 1-3 septate, 85-117 x 3-4 µm. Dr Dagmar Triebel kindly drew our attention to the correct author citation of the species name (given as *F. peltigerae* Westend. by Hawksworth 1979).

The species was known from the type collection from Belgium and from Sweden (Santesson 1993), both on specimens of *Peltigera rufescens* (Weis) Humb. Our collection from the Pyrenees was growing as a saprophyte on an unhealthy thallus of *Parmeliella testacea*.

This species was the only lichenicolous species of the genus recognized by Hawksworth (1979), but we have seen at least three other unidentified species of *Fusarium* with much smaller conidia growing on the thallus of *Pertusaria, Phlyctis* and *Parmelia* in the Pyrenees.

Hainesia pertusariae **Etayo & Diederich sp. nov.** (Fig. 1)

Conidiomata lichenicola, cupulata, discoidea, semi-immersa, atrobrunnea, 80-150 µm, basi stromatica, pariete brunneo, cellulis elongatis. Conidiophora elongata, filiformia, septata, hyalina. Cellulae conidiogenae enteroblasticae, integratae, sub conidiophorum septis crescentes atque ramos laterales brevissimos formantes, hyalinae, leves. Conidia hyalina, 0(-1)-septata, levia, filiformia, 14-22 x 1-1.5 µm.

Type: Spain, Navarra, Urroz de Santesteban, pantano de Leurtza, in a *Fagus* wood, on *Pertusaria* sp., 900 m, 13 Febr. 1994, *J. Etayo* 12699 (MA-Lich holotypus; herb. Diederich, herb. Etayo isotypi).

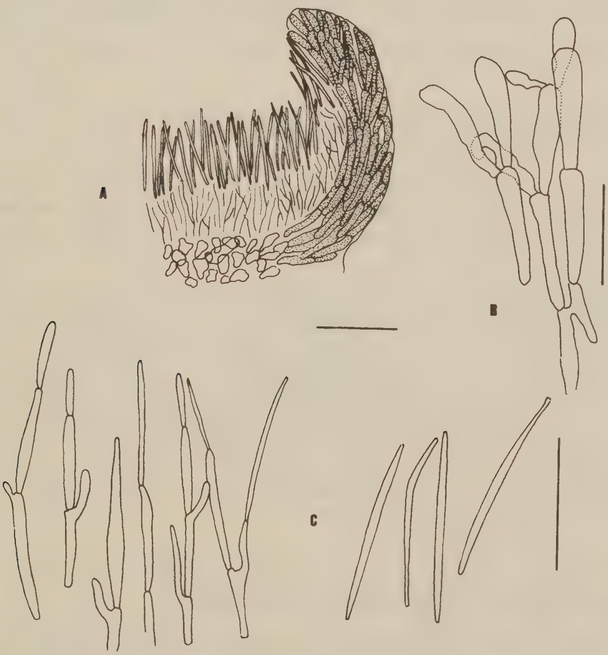


Fig. 1. *Hainesia pertusariae* (holotype). A, cross section through a conidioma. B, wall structure. C, conidiogenous cells and conidia. Scale bar = 10 µm.

Conidiomata cupulate, discoid to slightly elongate, concave, semi-immersed in the thallus of *Pertusaria*, dark brown, with a continuous or lobulate border, 80-150 µm in diam; wall brownish, 15-20 µm thick, hyphal, composed of elongate cells. Conidiophores arising from a basal stroma, 15-25 µm thick, composed of more or less polygonal, hyaline cells. Conidiophores elongate, filiform, simple or branched, septate, hyaline. Conidiogenous cells enteroblastic, integrated, appearing as short lateral branches just below each septum of the conidiophores, hyaline, smooth walled. Conidia hyaline, simple or indistinctly 1-septate, smooth-walled, filiform, 14-22 x 1-1.5 µm.

Host: *Pertusaria* sp. (thallus), on shaded *Fagus* wood. The holotype specimen is also infected by other lichenicolous fungi (*Cornutispora lichenicola* D. Hawksw. & B. Sutton and a brownish myxomycete).

Distribution: Known only from the type locality in Spain (Navarra).

Observations: This is the first lichenicolous species of the genus *Hainesia* Ell. & Sacc. The type species, *H. lythri* (Desm.) Höhn., has very similar conidiomata and a similar conidiogenesis, but is distinguished by much shorter conidia which measure 5-7.5 x 1.5-2 µm, and by a different ecology, the species growing mainly on leaves (Sutton 1980).

Lichenoconium cargillianum (Lindsay) D. Hawksw.

France: Pyrénées-Atlantiques, SW of Larrau, near the road to Spain, on *Usnea florida* (L.) Wigg., 29 July 1990, *P. Diederich* 9168; Pyrénées-Atlantiques, between col de Suscousse and Arette ski station, on *Platismatia glauca* (L.) Culb. & C. Culb., 23 June 1992, *J. Etayo* 12677.

This species has originally been described on '*Parmelia perforata*' from New Zealand; the host has recently been identified as *Rimelia cetrata* (Ach.) Hale & A. Fletcher (Triebel & al. 1995: 82). Hawksworth (1977) considers *Coniothyrium ramalinae* Vouaux, described on *Ramalina yemensis* (Ach.) Nyl. from Mexico, as a synonym of this species. Later Hawksworth (1981) reports the species from the British Isles on the apothecia of *Usnea florida*. Here we report it on *Usnea florida* and on *Platismatia glauca*. More specimens on all these hosts are needed to understand if they are really conspecific, or if several similar species are involved.

Lichenopuccinia poeltii D. Hawksw. & Hafellner

France: Pyrénées-Atlantiques, S of S^t-Jean-Pied-de-Port, forêt d'Iraty, 0.5 km S of chalet Pedro, 1000 m, on *Parmelia saxatilis*, 27 July 1990, *P. Diederich* 9236; *ibid.*, 19 July 1991, *P. Diederich* 9685 & *J. Etayo* 5936; *ibid.*, on *P. sulcata* Taylor, *P. Diederich* 9686; Pyrénées-Atlantiques, Bois d'Astaquieta, between Occabe and Sterençuby, 1200 m, on *P. saxatilis*, 18 April 1995, *J. Etayo* 12893; Vosges, Feigne d'Artimont, 1.2 km NNW of Kastelleg, 1100 m, on *P. sulcata*, 14 June 1975, *W. O.*

van der Knaap & H. F. van Dobben s. n. (herb. Aptroot, herb. Diederich). - *Spain*: Andalucía, Málaga, Estepona, Sierra Bermeja, subida a los Rales, 1235 m, on *P. sulcata*, 18 April 1994, *J. Etayo* 12285, *M. Casares, A. Gómez-Bolea & N. Hladun*; Navarra, W Pamplona, Sierra de Urbasa, P^{to} de Urbasa, on *P. saxatilis* and *P. sulcata*, 20 July 1991, *P. Diederich* 9640 & *J. Etayo* 5940; Navarra, N of Ochagavía, Iraty wood, NNE of the lake, Nature Reserve "Lizardoya", on *P. saxatilis*, 19 July 1991, *P. Diederich* 9668; Navarra, Espinal-Auzperri, on *P. sulcata*, 940 m, 4 Dec. 1994, *J. Etayo* 12700. - *Canada*: British Columbia, Kispiox area, ca. 9 km NNW of Town, N of Date Creek, 55°25' N, 127°48' W, 510 m, on *Parmelia hygrophila* Goward & Ahti, 12 July 1992, *T. Goward* 92-302 & *H. Knight* (UBC, herb. Diederich).

This hyphomycete was known from Austria, Greenland and Scotland, always growing on species of *Parmelia* s. s. (Hawksworth 1990). We report it here as new for France, Spain and Canada. It seems to be widespread, and rather common in areas with an oceanic climate.

Macrophomina pseudeverniae Etayo & Diederich sp. nov. (Fig. 2)

A *Macrophomina phaseolina* cellulis conidiogenis latis et phialidibus angustis minus distinctis differt.

Type: Spain, Huesca, road Sabiñánigo to Boltaña, Puerto del Serrablo, Sierra del Gabardón, km 39 near Laguarta, 1200 m, on *Pseudevernia furfuracea,* 5 July 1993, *J. Etayo* 12597 (MA-Lich holotypus; herb. Etayo isotypus).

Mycelium immersed, hyaline. Conidiomata pycnidial, separate, globose, dark brown to black, immersed, unilocular, 130-170 µm in diam.; wall composed of a brown textura angularis, paler inside, darker near the ostiole; cells thin-walled, 6-18 x 5-15 µm. Ostiole central, circular, slightly papillate. Conidiophores absent. Conidiogenous cells enteroblastic, discrete, determinate, ampulliform, hyaline, smooth, often indistinct, 7-10 x 6-7 µm. Conidia hyaline, aseptate, obtuse at each end, sometimes slightly constricted at the point of attachment, straight, cylindrical, ellipsoid or sometimes irregular in form, thin-walled, smooth, with small guttulae, (14-)16-22(-26) x 6-9 µm.

Host: The species is parasitic on the thallus of *Pseudevernia furfuracea* (L.) Zopf growing on *Pinus sylvestris*. Infected parts of the thallus get pinkish brown.

Distribution: Only known in more or less continental areas of northern Spain (Huesca and Navarra) where the species seems to be not rare.

Observations: The phialides in the new species are narrow and sometimes indistinct. In the type species of the genus, *Macrophomina phaseolina* (Tassi) Goid., the phialides are very distinct, with a wide aperture, and the conidiogenous cells are narrower (5-13 x 4-6 µm); that species is plurivorous (Sutton 1980).

Additional specimens (all on *Pseudevernia furfuracea*): *Spain*: Huesca, Aragües del Puerto, 26 Aug. 1991, *J. Etayo* 770; Huesca, Piedrafita, track to Peña Telera, 1400 m, 4 Aug. 1993, *J. Etayo* 12598; Navarra, Sierra de Illón, monte Belbún, Navascués, 2 km from Castillonuevo, 1250 m, 11 June 1994, *J. Etayo* 12599, 12600 (herb. Etayo, herb. Diederich); Navarra, Belabarce, 25 July 1987, *J. Etayo* 3209.

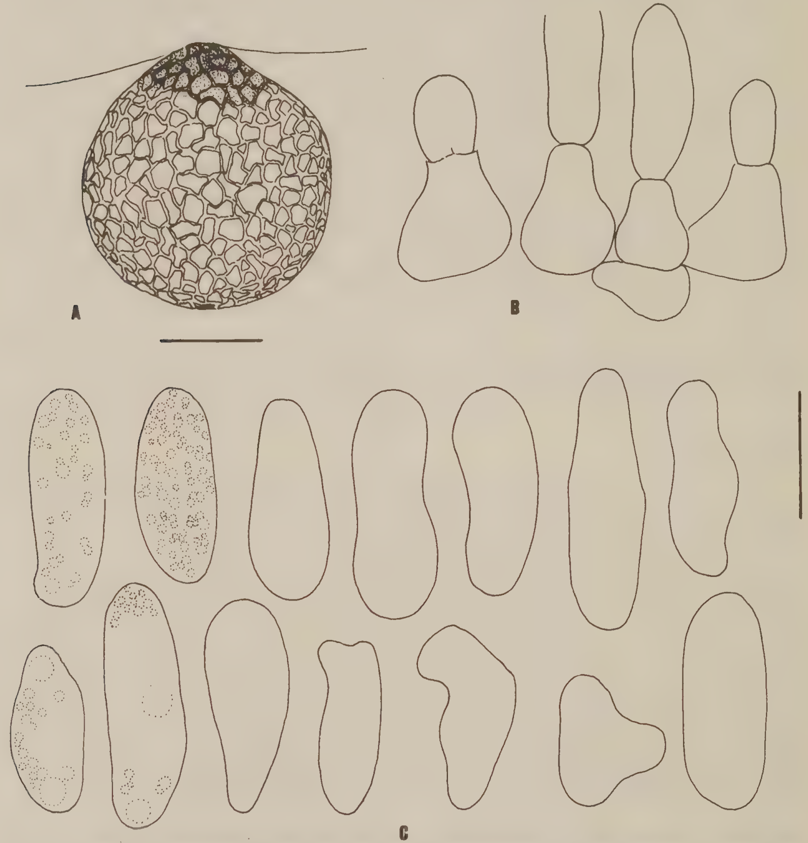


Fig. 2. *Macrophomina pseudeverniae* (holotype). A, immersed conidioma showing textura angularis of the wall. B, conidiogenous cells with conidia. C, conidia. Scale bars: A = 50 µm; B, C = 10 µm.

Marchandiomyces corallinus (Roberge) Diederich & D. Hawksw. s. l.

The genus *Marchandiomyces* Diederich & D. Hawksw. has been created to include the fungus previously known as *Illosporium corallinum* Roberge. The conidiogenesis, and more generally the nature of the different cells visible inside one fructification, are very difficult to interpret (Hawksworth 1979: 236, Diederich 1990). Dr Rosalind Lowen informed us about her most interesting discovery that dolipores have been found in American material of *M. corallinus* (s. l.!), showing that it represents a basidiomycetous anamorph.

Hawksworth (1979: 237) correctly noted that the species (i. e. *M. corallinus* s. l.) presents some variation in the colour of the fructifications, and that the orange and the pink specimens could well belong to two different species. Field studies in Luxembourg and in the western Pyrenees allow us to affirm that at least two different species are involved:

1. *Marchandiomyces aurantiacus* (Lasch) Diederich & Etayo comb. nov.

Basionym: *Illosporium aurantiacum* Lasch, *in* Rabenhorst, *Fungi Eur.*, cent. I, n° 74, 1859.

Type: Germany, in lichenibus trunci Pyri mali pr. Driesen, G. W. Lasch, Rabenh. *Fungi Eur.*, cent. I no. 74 (K, M, UPS - isotypes!).

Exsiccatae: Fuckel *Enumeratio Fungorum Nassoviae*, ser. I no. 206 (M! sub *I. aurantiacum*). - Fuckel *Fungi rhenani,* no. 239 (M!, sub *I. aurantiacum*), 241 (M!, UPS!, sub *I. roseum* Fr.). - Rabenhorst *Fungi Eur.*, cent. I no. 74 (K!, M!, UPS!, sub *I. aurantiacum*).

A light orange species (Kornerup & Wanscher 1984: 5A4, the colour corresponds to recent herbarium specimens) with fructifications always superficial, growing on macrolichens in the Xanthorion communities, mainly on *Phaeophyscia*, *Physcia* and *Xanthoria*; this species is quite common in the industrialized and polluted south-western part of Luxembourg, but has not been found in the western Pyrenees. It is often found together with *Hobsonia christiansenii.* We studied three isotypes of *Illosporium aurantiacum* Lasch (K!, M!, UPS!): the specimens are now in a poor condition, and only a few superficial or slightly immersed fructifications could be seen over a thallus of *Physcia adscendens.* In the original description the colour of the fungus is said to be orange (‘*aurantiacum*’); due to the age of the specimens, the fructifications are now pale, which is typical for old specimens of this species. We conclude therefore that the type specimen of *I. aurantiacum* belongs to the species with orange fructifications, which has therefore to be called *Marchandiomyces aurantiacus.*

Hosts: We have seen material on *Phaeophyscia orbicularis* (Neck.) Moberg, *Physcia adscendens* (Fr.) H. Olivier, *P. caesia* (Hoffm.) Fürnr., *P. semipinnata* (J. F. Gmelin) Moberg, *P. stellaris* (L.) Nyl., *P. tenella* (Scop.) DC., *Xanthoria candelaria* (L.) Th. Fr. and *X. parietina* (L.) Th. Fr.

Distribution: We have seen specimens from Austria, France, Germany, Luxembourg, Spain and Sweden.

Additional specimens (Luxembourg specimens of this species published by Diederich 1990, sub *M. corallinus*, are not repeated here): *France*: Gard, near Pont du Gard, on *Physcia tenella*, 13 April 1995, *P. Diederich* 12323. - *Germany*: Württemberg, Schwäbische Alb, Winterlingen, Harthausen, 720 m, on *P. tenella*, 9 Nov. 1993, *M. Heklau* s. n. (STU, herb. Diederich). - *Luxembourg*: Kockelscheuer, on

P. tenella, 7 Oct. 1993, *L. Reichling* s. n. (herb. Diederich). - *Spain*: Andalucía, Málaga, Ronda, pinsapar de la Cañada del Cuerno, 1500 m, on *P. semipinnata*, *J. Etayo* 12217, 12679; Navarra, Larra, Eskilzarra, near refugio, 1400 m, on *P. caesia*, 29 Aug. 1995, *J. Etayo* 12858; Navarra, alto de Erro, 800 m, on *Xanthoria parietina*, 18 April 1995, *J. Etayo* 12878. - *Sweden*: Södermanland, Över-Järna s:n, Bankesta Gård., on *P. tenella*, 1 Jan. 1947, *R. Santesson* s. n. (UPS).

2. *Marchandiomyces corallinus* (Roberge) Diederich & D. Hawksw.

Type: France, on *Physcia tenella*, *J. B. H. J. Desmazières*, *Pl. crypt. Fr.*, Ed. 1, fasc. 32 no. 1551 (K - isotype!).

Exsiccatae: Desmazières *Pl. crypt. Fr.*, Ed. 1, fasc. 32 no. 1551 (K!). The specimen *P. Diederich* 12325 will be distributed in Santesson *Fungi Lich. Exs.*

A pinkish or reddish species (Kornerup & Wanscher 1984: 8A5, pastel red) with young fructifications developing inside the lichen thallus, erumpent and later superficial, often leaving holes in the lichen thallus, sometimes spreading afterwards superficially over the lichen thallus, growing in less polluted and more humid areas, generally in forests, often on *Parmelia* s. l. species; this species has been collected several times in the western Pyrenees by the authors, but is not known from Luxembourg. Its colour is similar to that of *Hobsonia christiansenii* Brady & D. Hawksw., but both species have a different ecology and never grow together. The type specimen of *Illosporium corallinum* Roberge (K!) belongs to this species, which has therefore to be called *Marchandiomyces corallinus*. In the type specimen, numerous pinkish fructifications develop inside the thallus of *Physcia adscendens* and later become superficial; neighboring thalli of *Xanthoria parietina* are also attacked. The original description (Desmazières, *Pl. crypt. Fr.*, Ed. 1, fasc. 32 no. 1551, 1847) says that 'Cet *Illosporium* naît dans la substance du support, et la déchire pour devenir superficiel. ... Ils sont d'un rose carné, et recouverts d'une très-légère poussière blanche.', which corresponds perfectly to the pinkish species collected in the Pyrenees.

Hosts: The species is known from *Acarospora fuscata* (Schrad.) Th. Fr., *Flavoparmelia caperata* (L.) Hale, *Hypotrachyna revoluta* (Flörke) Hale, *Melanelia exasperata* (De Not.) Essl., *M. glabratula* (Lamy) Essl., *M. panniformis* (Nyl.) Essl., *Melanelia* sp., *Parmelia omphalodes* (L.) Ach., *P. saxatilis* (L.) Ach., *P. sulcata* Taylor, *Parmelina quercina* (Willd.) Hale, *Parmeliopsis ambigua* (Wulfen) Nyl., *Parmotrema crinitum* (Ach.) M. Choisy, *Pertusaria multipuncta* (Turner) Nyl., *P. pertusa* (Weigel) Tuck., *P. pustulata* (Ach.) Duby, *Physcia adscendens*, *P. aipolia* (Ehrh. ex Humb.) Fürnr., *Ramalina fastigiata* (Pers.) Ach., *Usnea* sp. and *Xanthoria parietina*.

Distribution: We have seen specimens collected in Austria, the Canary Islands (Gomera), France, Norway, Spain and Switzerland.

Additional specimens: *Austria*: Oberösterreich, Donautal, Freizell, am Grat gegenüber Schloss Marsbach, on *Acarospora fuscata*, 1 Aug. 1993, *F. Berger* 6763 (herb. Berger). - *Canary Islands*: Gomera, Hermigua, mirador de El Bailadero, alt. 1010 m, on *Usnea*, 4 Aug 1994, *J. Etayo* s. n. - *France*: Finistère, S^t Herbot, château du Rusquec, on *Pertusaria pertusa*, 19 July 1954, *R. Santesson* 10256 (UPS); Pyrénées-Atlantiques, SSW of Mauléon-Licharre, forêt des Arbailles, S of S^t-Just-Ibarre, vallon du Bidouze, 0.5 km S of Arla, on *Parmotrema crinitum*, 27 July 1990, *P. Diederich* 9297; Pyrénées-Atlantiques, Orthez, route de Pau, on *Flavoparmelia caperata*, *S. Bahler* s. n. (herb. Aptroot); Pyrénées-Atlantiques, vallée d'Aspe, near Urdos, on *Parmelina quercina*, 1995, *J. Etayo* 12717; Pyrénées-Atlantiques, vallée d'Aspe, near Estaut, gorges de Pont d'Enfer, on *Ramalina fastigiata*, 7 Dec. 1993, *J. Etayo* 12676; Pyrénées-Atlantiques, col d'Ibardin, La Redoute des Emigrés, on *P. crinitum*, 14 March 1995, *J. Etayo* 12702 & *B. Marbach*; Vaucluse, 2 km S of Gordes, col de Gordes, on *Physcia aipolia*, 21 April 1995, *P. Diederich* 12325, *G. Clauzade*, *P. Navarro* & *C. Roux*. - *Norway*: Oppland, Vågå, Veomoan, on *Melanelia panniformis*, 7 Aug. 1985, *R. Santesson* 31265 & *P. M. Jørgensen* (UPS); Sör-Tröndelag, Brekken herred, near Botnlia, 4-5 km SSW of Brekken, on *M. exasperata*, 31 July 1986, *R. Santesson* 31546c (UPS). - *Spain*: Catalunya, Girona, on *Melanelia* sp., Oct. 1989, *B. Matesanz* s. n. (BCC, herb. Diederich); Navarra, Narbarte, on *P. omphalodes*, *P. saxatilis* and *P. sulcata*, 3 Sept. 1991, *J. Etayo* 13107, 13108, 13109; Navarra, Roncesvalles, Lindux, on *P. sulcata*, 15 Sept. 1991, *J. Etayo* 6013; Navarra, Oronoz-Mugaire, Señorío de Bértiz, on *Hypotrachyna revoluta*, 13 Nov. 1992, *J. Etayo* 3734; Navarra, 20 km E of San Sebastian, Col d'Ibardin, on *F. caperata* and *M. glabratula*, 22 July 1991, *P. Diederich* 9758 & *J. Etayo* 5980; Navarra, valle de la Ulzama, Alcoz, on *Pertusaria pustulata*, May 1993, *J. Etayo* 12703; Navarra, between Roncesvalles and Valcarlos, km 55.5, on *P. multipuncta*, 1995, *J. Etayo* 12883. - *Switzerland*: Wallis, Bourg-S^t-Pierre, nahe dem S^t-Bernhard-Paß, Waldweg an der Ostflanke des Créta de Vella, im Foret du Milieu, on *Parmeliopsis ambigua*, 10 June 1991, *C. Printzen* 2138 (M).

3. *Marchandiomyces* sp.

A number of specimens cannot be included in a convincing way in one of these two species; they are either too old or in a poor condition, or they might belong to different undescribed species. Two specimens with brownish (cinnamon) fructifications (Kornerup & Wanscher 1984: 6D6) have been collected in Luxembourg (*Diederich* 8442) and in Sweden (*R. Santesson* 48.502d, UPS); they represent most probably a third species, but we prefer to await the discovery of additional specimens before describing it as new. Several North American specimens on *Cladonia stellaris* (Opiz) Pouzar & Vezda, *Lasallia papulosa* (Ach.) Llano and *Rhizoplaca chrysoleuca* (Sm.) Zopf (*Harris* 16637, 16638, 16642 NY) have pale yellowish or brownish yellowish fructifications (Kornerup & Wanscher 1984: 4A4); they don't seem to belong to one of the two named species; it is important to note that the specimen on *Rhizoplaca* (*Harris* 16642) has been used by Dr Lowen to study the dolipores, and that her discoveries are thus not based on *M. aurantiacus* or *M. corallinus*, but on an apparently undescribed species of *Marchandiomyces*.

Milospium lacoizquetae **Etayo & Diederich sp. nov.** (Fig. 3)

Fungus lichenicola. Conidiophora in sporodochiis densis convexis atrobrunneis, rotundatis, (30-)50-100(-120) µm, semi-macronemata, simplicia, determinata. Cellulae conidiogenae monoblasticae, integratae, terminales, determinatae. Conidia variabilia, verruculosa, brunnea, 7-14(-16) x 6-10(-12) µm, cum maculis obscurioribus.

Type: Spain, Navarra, Oronoz-Mugaire, Señorío de Bértiz, 360 m, 30TXN1579, in a *Fagus* wood, on *Cladonia parasitica*, 4 Jan. 1994, *J. Etayo* (MA-Lich holotypus; herb. Etayo isotypus).

Colonies forming convex, blackish, rounded sporodochia, (30-)50-100 (-120) µm in diam.; mycelium immersed in the host thallus. Conidiophores semi-macronematous, agglomerated in very dense sporodochia. Conidiogenous

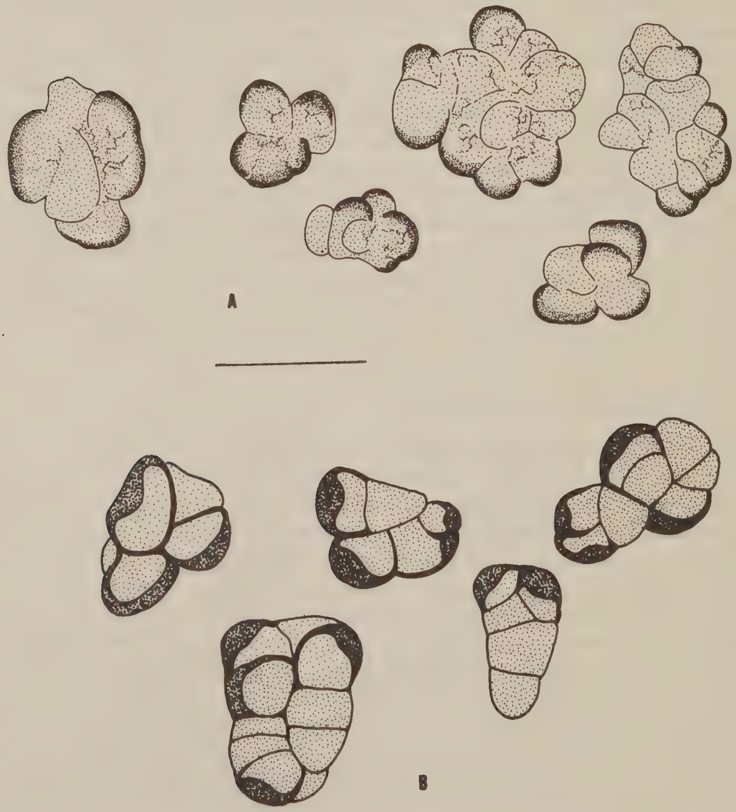


Fig. 3. A, *Milospium lacoizquetae* (holotype), conidia. B, *Sclerococcum serusiauxii* (*J. Etayo* 1458), conidia. Scale bar = 10 µm.

cells monoblastic, integrated, terminal, determinate. Conidia variable in form, brown, more or less lobed, apparently non septate, 7-14(-16) x 6-10(-12) µm, lobes (2-)3-5(-7) µm, wall verruculose, unevenly thick, the thicker parts darker than the rest of the conidia.

Etymology: The new species is named in honour of the neglected and keen lichenologist P. Lacoizqueta (1831-1889), who lived in the valley of the type locality.

Host: *Cladonia parasitica* (Hoffm.) Hoffm., mainly on the tip of squamules. The fungus is parasitic, causing small brownish patches in the host thallus.

Distribution: Known only from very shaded and well preserved valleys in the north of Navarra (Spain).

Observations: This is the second species of the genus *Milospium*, the other being *M. graphideorum* (Nyl.) D. Hawksw. (Hawksworth 1979). *M. lacoizquetae* differs in the very small conidiomata, in the conidia which are more lobed and in the different host (*M. graphideorum* grows on crustose lichens with *Trentepohlia* as the photobiont) on which it forms brown sporodochia. *M. lacoizquetae* also resembles *Sclerococcum serusiauxii* Boqueras & Diederich in conidial shape and size (Boqueras & Diederich 1993), but the conidial wall in the new species is much thinner and broken with many fissures, the wall thickenings are not so evident and the conidia are not septate (see Fig. 3).

Additional specimen: *Spain*: Navarra, between Errazu and Izpegui, on *Cladonia parasitica*, 440 m, 6 March 1994, *J. Etayo* 12452 (herb. Etayo, herb. Diederich).

Pyrenochaeta xanthoriae Diederich

Spain: Navarra, W Pamplona, Sierra de Urbasa, P^{to} de Urbasa, 20 July 1991, *P. Diederich* 9630 & *J. Etayo* 5692; Navarra, Cilveti, 4 Dec. 1994, *J. Etayo* 12552; Navarra, Fustiñana, Las Bardenas, caídas de La Negra, 600 m, 26 Febr. 1995, *J. Etayo* s. n.; Navarra, alto de Erro, 800 m, 18 April 1995, *J. Etayo* 12880; Soria, Calatañazor, pista a La Fuentona, 1000 m, 27 Aug. 1995, *J. Etayo* s. n.

This species was previously known from Luxembourg (Diederich 1990) and from Spain (Zaragoza) (Etayo & Blasco Zumeta 1992). All known records are on epiphytic thalli of *Xanthoria parietina*.

Sclerococcum parmeliae Etayo & Diederich sp. nov. (Fig. 4)

Conidiomata lichenicola, sporodochia, rotundata, convexa, superficialia, griseofusca, 50-120 µm. Conidiophora semi-macronemata. Cellulae conidiogenae monoblasticae, integratae, terminales, ellipsoideae, griseae vel fuscae. Conidia catenata, sicca, acrogena, (0-)1(-2-)septata, ellipsoidea, grisea vel fusca, pariete rugosa, 7-9 x 3.5-5 µm.

Type: Spain, Navarra, valle de Basaburúa Mayor, between Aizároz and Arrarás, track to Bergañe, on *Fagus sylvatica*, on *Parmelia saxatilis*, 550 m, 20 Sept. 1994, *J. Etayo* 12688 (MA-Lich holotypus; herb. Etayo isotypus) (also present on *P. sulcata* in the type collection).

Colonies forming discrete patches or forming a mass on the thallus of the host; mycelium immersed, brownish. Conidiophores semi-macronematous, aggregated into tufted, more or less rounded, convex, greyish brown, simple to aggregated, superficial sporodochia of 50-120 µm in diam., grey or pale brown. Conidiogenous cells monoblastic, integrated, terminal, ellipsoid, grey or brown, not clearly defined and the terminal cells acting in turn as conidiogenous cells. Conidia adhering in chains, dry, acrogenous, (0-)1(-2)-septate, ellipsoid, constricted at the septum or not, sometimes with one or two pointed ends, grey to brown, ornamented, 7-9 x 3.5-5 µm.

Hosts: On corticolous thalli of *Parmelia* s. l. (*Flavoparmelia caperata*, *Hypotrachyna revoluta*, *Parmelia saxatilis*, *P. sulcata*, *Punctelia subrudecta* (Nyl.) Krog and *Rimelia reticulata* (Taylor) Hale & A. Fletcher). As the hosts are often in a bad condition and support other lichenicolous fungi, it is not clear wheter *S. parmeliae* is saprophytic or parasitic.

Distribution: French and Spanish Pyrenees, common but apparently overlooked.

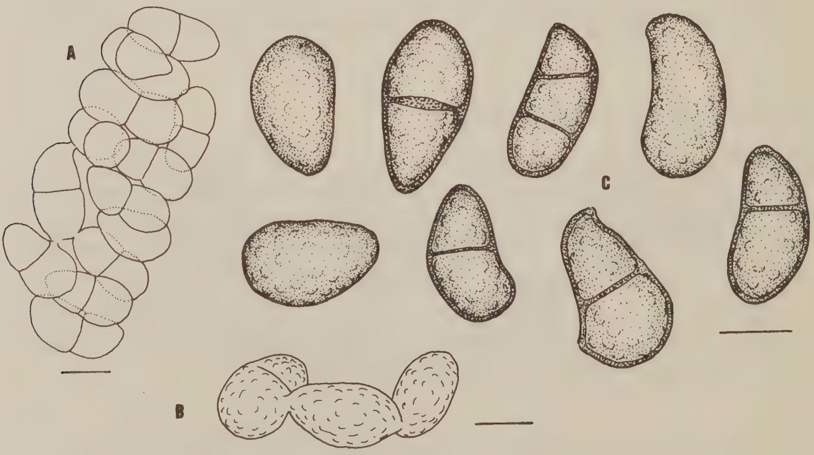


Fig. 4. *Sclerococcum parmeliae* (holotype). A, chains of conidiogenous cells and conidia. B, attachment of conidia. C, conidia (wall ornamentation represented on the left conidium). Scale bar = 5 µm.

Observations: The new species is well characterized by the ellipsoid, normally 1-septate conidia attached diagonally in columns. All other known species of the genus have conidia which are either non-septate or more than 1-septate. The conidiomata are sometimes aggregated, forming brownish grey masses on the thallus of the host.

Additional specimens: *France*: Pyrénées-Atlantiques, col de Lizuniaga, c. 5 km from Bera de Bidasoa, on *Flavoparmelia caperata,* 5 March 1994, *J. Etayo* 12674 (herb. Etayo, herb. Diederich); Pyrénées-Atlantiques, S^t-Pée, 3 km from the village to Ustaritz, 150 m, on *Hypotrachyna revoluta,* 6 March 1994, *J. Etayo* 12682; *ibid.*, on *Punctelia subrudecta*, *J. Etayo* 12670, 12918; Pyrénées-Atlantiques, 5 km from Bera de Bidasoa (close to the Navarra border), bois de Sare, col de Lizuniaga, 150 m, on *Rimelia reticulata*, 14 March 1995, *J. Etayo* 12697; *ibid.*, on *F. caperata*, *J. Etayo* 12698. - *Spain*: Navarra, Oronoz-Mugaire, señorío de Bértiz, 400 m, on *F. caperata,* 4 Jan. 1994, *J. Etayo* 12680, 12675; Navarra, Urroz de Santesteban, pantano de Leurtza, 900 m, on *H. revoluta,* 13 Febr. 1994, *J. Etayo* 12673; Navarra, valle de la Ulzama, amongst Oroquieta and Saldías, km 7, 950 m, on *H. revoluta,* Febr. 1994, *J. Etayo* 12672; Navarra, valle de Basaburúa Mayor, amongst Aizároz and Arrarás, track way to Bergañe, 550 m, on *F. caperata,* 20 Sept. 1994, *J. Etayo* 12671.

Sclerococcum simplex D. Hawksw.

France: Pyrénées-Atlantiques, S of S^t-Jean-Pied-de-Port, forêt d'Iraty, 0.5 km S of chalet Pedro, alt. 1000 m, on *Pertusaria pertusa*, 27 July 1990, *P. Diederich* 9222; Pyrénées-Atlantiques, S of Pau, W of Bielle, 0.5 km E of col de Marie-Blanque, on *P.* cf. *ophthalmiza* (Nyl.) Nyl., 28 July 1990, *P. Diederich* 9329; Pyrénées-Atlantiques, col de Lizuniaga, 5 km from Bera de Bidasoa, 150 m, on *P. albescens* (Hudson) M. Choisy & Werner, 5 March 1994, *J. Etayo* 12669. - *Spain*: Navarra, N of Orbaiceta, N of Fabrica de Orbaiceta, on *Pertusaria* sp., 19 July 1991, *P. Diederich* 9623; Navarra, Valcarlos, near the French border, 600 m, on *P. multipuncta*, 19 April 1995, *J. Etayo* 12922.

This species was known only from the type collection on *Pertusaria* cf. *ophthalmiza* in the British Isles (Hawksworth 1979). Alstrup & Hawksworth (1990) also mentioned it on *Melanelia tominii* (Oxner) Essl. (= *M. substygia* (Räsänen) Essl.) from Greenland, but the corresponding specimen is likely to belong to one of the numerous undescribed species of the genus.

Acknowledgments

We would like to thank the curators of K, M, STU and UBC, as well as Drs André Aptroot and Franz Berger for the loan of specimens, Dr Rosalind Lowen for useful informations on species of *Marchandiomyces* and Drs Claude Roux and Dagmar Triebel for precious comments on the text. The first author is obliged to the DGICYT, project PB92/0795, for partial financial support.

References

Alstrup, V. & D. L. Hawksworth, 1990. The lichenicolous fungi of Greenland. *Meddelelser om Grønland, Bioscience* **31**: 1-90.

Boqueras, M. & P. Diederich, 1993. New or interesting lichenicolous fungi. 3. *Karsteniomyces llimonae* sp. nov. and *Sclerococcum serusiauxii* sp. nov. (Deuteromycotina). *Mycotaxon* **47**: 425-431.

Diederich, P., 1990. New or interesting lichenicolous fungi. 1. Species from Luxembourg. *Mycotaxon* **37**: 297-330.

Etayo, J. & J. Blasco Zumeta, 1992. Líquenes epífitos de zonas áridas. El sabinar de la Retuerta de Pina (Los Monegros, España). *Acta Botanica Malacitana* **17**: 67-78.

Etayo, J. & P. Diederich, 1995. Lichenicolous fungi from the Western Pyrenees, France and Spain. I. New species of Deuteromycetes. *In*: Flechten Follmann. Contributions to Lichenology in Honour of Gerhard Follmann (Ed. F. A. J. Daniels, M. Schulz & J. Peine), Geobotanical and Phytotaxonomical Study Group, Botanical Institute, Cologne, p. 205-221.

Hawksworth, D. L., 1977. Taxonomic and biological observations on the genus *Lichenoconium* (Sphaeropsidales). *Persoonia* **9**: 159-198.

Hawksworth, D. L., 1979. The lichenicolous Hyphomycetes. *Bull. Br. Mus. nat. Hist. (Bot.)* **6**: 183-300.

Hawksworth, D. L., 1981. The lichenicolous Coelomycetes. *Bull. Br. Mus. nat. Hist. (Bot.)* **9**: 1-98.

Hawksworth, D. L., 1990. Notes on British lichenicolous fungi: VI. *Notes RBG Edinb.* **46**: 391-403.

Kornerup, A. & J. H. Wanscher, 1984. Methuen Handbook of Colour, ed. 3. Methuen, London, 252 p.

Santesson, R., 1993. The lichens and lichenicolous fungi of Sweden and Norway. SBT, Lund, 240 p.

Sérusiaux, E. (in press). A preliminary list of foliicolous lichens from Madeira, with the description of a new genus and two new species. Lichenologist.

Sutton, B. C., 1980. The Coelomycetes. Fungi Imperfecti with Pycnidia, Acervuli and Stromata. Commonwealth Mycological Institute, Kew, 696 p.

Triebel, D., G. Rambold & J. A. Elix, 1995. A Conspectus of the Genus *Phacopsis* (Lecanorales). *The Bryologist* **98**: 71-83.

MYCOTAXON

Volume LX, pp. 429-432 October-December 1996

A new species of *Botryobasidium* (Corticiaceae, Aphyllophorales) inhabiting the interiors of brown rotted logs of ponderosa pine[1]

MICHAEL J. LARSEN and ALAN E. HARVEY
USDA Forest Service, Intermountain Research Station,
Moscow, ID

ROBERT POWERS
USDA Forest Service, Pacific Southwest Research Station,
Redding, California

MARTIN F. JURGENSEN
School of Forestry and Wood products
Michigan Technological University
Houghton, Michigan

Key words -- *Botryobasidium ponderosum, B. medium, B. subcoronatum, Haplotrichum* anamorph, California, ponderosa pine.

ABSTRACT

Botryobasidium ponderosum is described as a new species associated with a Haplotrichum anamorph. Basidiomata of this fungus were found in the interior of brown rotted logs of *Pinus ponderosa*. The new species is similar in some respects to *B. medium* and *B. subcoronatum*.

INTRODUCTION

In 1993 a multidisciplinary ecosystem study was installed at the Black's Mountain Experimental Forest (BMEF), within the Lassen National Forest, in northern California. Forest conditions at BMEF are typical of the Eastside Pine type (SAF 237; Erye, 1980) that extends from Baja, California, north into central British Columbia. This ecosystem is characterized by a cool, dry continental climate. Air temperatures vary between -9°C and 29°C. Annual precipitation averages 460 mm, falling partly as summer thunderstorms, but mainly as winter snow. Frost may occur in any month. Natural fire, normally a periodic event in this forest type, has been reduced substantially because of fire suppression policies that began early this century. Ecologically, the area has been typed as Yellow pine/Purshia tridentata/Idaho Fescue (Alexander, 1993). Soils are Mollisols derived from Quarternary basaltic flow rocks.

---

[1] This article is contribution no. 003 of the Black's Mountain Interdisciplinary Research Project, Pacific Southwest Research Station, USDA Forest Service. It was written and prepared by U.S. Government employees on official time, and is therefore in the public domain and not subject to copyright.

As a part of this study an investigation into the interior mycoflora of brown rotted *Pinus ponderosa* Laws logs was initiated. These logs were stems of overmature trees that were toppled by wind at least 50 years previously. Before falling, they were most likely snags with advanced stages of root and heart decay triggered initially by *Heterobasidion annosum* (Fr.) Bref. Three one meter sections one each, from the top, middle, and base of fifteen such logs were systematically dismantled and scrutinized for the occurrence of basidiomata. One conspicuous basidiomycetous species occurring in the interior of inspected logs proved to be an undescribed species of *Botryobasidium* that we have named *B. ponderosum*.

Data on microscopic characteristics were obtained from small portions of a basidiocarp squash-mounted in 5 percent KOH and stained with 1 percent Phloxine B or lactophenol cotton blue (Johansen, 1940). Melzer's reagent (Melzer, 1924) was used to detect amyloid or dextrinoid structures. Capital letters used to designate herbaria are those of Holmgren et al. (1981).

Botryobasidium ponderosum M. Lars., sp. nov.   Fig. 1a-g

Etymology--Named for the host substrate *Pinus ponderosa* Laws.

Basidiomatibus effusis, arachnoideis; hyphis totis septatis fibulis; basidiis 7.5-10(-12) x 4-5 μm, suburniformibus, 6-8 sterigmatibus; basidiosporis 6.5-7.5(-8) x 2.5-3 μm, navicularibus; imperfecto statu *Haplotricho*, conidiophoris longitudinis indeterminatis, 4-5 μm diam., conidiis singularis or catenulatis, interdum verticillastris, totis septatis fibulis, 20-27 x 7-9(-10) μm, fusiformibus vel ovalibus, hyalinis.

Basidiomata effused, hypochnoid, pale gray to dull white, ca. 100 μm thick, growth indeterminate; *subicular hyphae* (6-)7-8(-10) μm diam., with clamp connections at all septa, hyaline to faintly citrine, some wall thickening in the more basal larger diam. hyphae; *subhymenial hyphae* 4-5-6 μm diam.,branching frequently, hyaline, clamp connections at all septa; *basidia* 7.5-10(-12) x 4-5 μm, suburniform, 6-8 sterigmate; *basidiospores* navicular, 6-7.5(-8) x 2.5-3 μm, hyaline, negative in Melzer's reagent. Cyanophilous structures absent.

Anamorph -- *Haplotrichum*. *Subicular hyphae* (6-)7-8(-10)μm diam., clamp connections at all septa; *conidiophore* length not determinable, 3.5-4.5 μm diam., apparently originating from subicular and subhymenial hyphae, often fragmenting into individual cells 35-45 x 3.5-4.5 μm (functioning as conidia?), clamp connections at all septa, hyaline; *conidia* blastosporic, born singly, laterally and apically, or frequently catenulate and then produced acropetally, sometimes appearing verticillate at conidiophore apex, clamp connections at all septa, including conidiophore/conidia points of attachment and between catenate conidia, 20-27 x 7-9(-10) μm, fusiform to oval, hyaline.

Holotype - USA, California, Blacks Mt. Experimental Forest, Lassen National Forest, on *Pinus ponderosa* Laws. collected M. J. Larsen, 13 IV 94, FP no. 135881 (CFMR). Additional specimens examined - USA, California, Black's Mt. Experimental Forest, Lassen National Forest, on *P. ponderosa,* collected by M. J. Larsen, 13 IV 94, nos. FP 135882, 135883, 135884, 135885, 135886, 135887, 135888, 135889, 135890, 135891, 135892 (CFMR).

Remarks: *Botryobasidium ponderosum* is readily diagnosed by the occurrence of clamp connections at all septa in both teleomorph and anamorph, size [7.5-10(-12) x 4-5 μm] of suburniform basidia and size [6-7.5(-8) x 2.5-3 μm] of navicular basidiospores. *Botryosidium medium* J. Erikss. (nomenclatural type examined: B. and J. Erikss. 2126) is strikingly similar to *B. ponderosum* but the former lacks clamp connections on conidiophores and between conidia (Langer, 1994; Holubova-Jechova, 1969). Basidiospore size in *B. medium* is considerably larger [9-12 x 5-6(-6.5) μm] (see Langer, 1994, Eriksson, 1958. *Botryobasidium subcoronatum* (Hoehn. et Litsch.) Donk is also similar, especially with regard to spore size and shape. However, this species lacks the *Haplotrichum* anamorphic state (Langer, 1994; Eriksson and Ryvarden, 1973; Chrisiansen 1960; Eriksson, 1958; Rogers, 1935). However, Linder (1942) reported that he was able to trace the connection between conidia of *Oidium curtisii* (Berk.) Linder and basidia of *B. subcoronatum.* Hallenberg (1978), though, has shown that *O. curtisii* [(*Haplotrichum curtisii* (Berk.) Holub.-Jech.)] is the anamorph of *B. curtisii* Hallenb. Finally, Talbot (1965) cites an *Oidium* state for *B. subcoronatum* and describes, in the key to species of *Botrybasidium*, conidia that are fusoid and 15-20 x 6-9μm, and basidiospores 6.5-8.5(-15) x (2-)3-4(-5)μm. There is insufficiant data in Talbot (1965) to draw any conclusions with regard to what species he really had, but we note the similarity of the dimensions of conidia and basidiospores to those of *B. ponderosum.*

Apparently, *Botryobasidium ponderosum* is a widely distributed and ubiquitous fungus in logs in this area. When comparing it's occurrence in stands harvested fifty years ago vs. non harvested stands, there appears to be no discernable difference. The species appears to be restricted to a narrowly defined ecological niche.

ACKNOWLEDGMENTS

We gratefully acknowledge the field assistance and technical support of christine Siegle, Bert Spear, and Kendall Kilborn of the USDA Forest Service, Pacific Southwest Research Station, Redding.

LITERATURE CITED

ALEXANDER, E.B. 1993. Ecological unit inventory. Blacks Mountain Experimental Forest, California. Unpublished report on file ot the Pacific Southwest Research Station, Redding, CA. 87p.

CHRISTIANSEN, M.P. 1960. Danish respinate Fungi. II. Homobasidiomycetes. Dansk Bot. Ark. 19: 57-388.

ERIKSSON, J. 1958. Studies in the Heterobasidiomycetes and Homobasidiomycetes -- Aphyllophorales of Muddus National Park in North Sweden. Symb. Bot. Upsal. 16: 1-172.

ERIKSSON, J., and L. RYVARDEN. 1973. The Corticiaceae of North Europe. 2. *Aleurodiscus - Confertobasidium*. Fungiflora, Oslo. PP. 59-261.

EYRE, F.H. (ed.) 1980. Forest cover types of the United States and Canada. Society of American Foresters, Washington, DC. 148p.

HALLENBERG, N. 1978. Wood-Fungi (Corticiaceae, Coniophoraceae, Lachnocladiaceae, Thelephoraceae) in N. Iran I. Iran. J. Plant Path. 14: 38-87.

HOLMGREN, P. K., N. HOLMGREN, AND L. BARNETT 1990. Index herbariorum. Part I. The herbaria of the world. Reg. Veget. 120: 1-693.

HOLUBOVÁ-JECHOVA, V. 1969. New species of the genus *Oidium* Link ex Fr. emend Linder. Česká Mykol. 23: 209-221.

JOHANSEN, D.A. 1940. Plant Microtechnique. McGraw-Hill Book co., New York-London. 523 pp.

LANGER, G. 1994. Die Gattung *Botryobasidium* Donk (Corticiaceae, Basidiomycetes). Bibl. Mycol. 158: 1-459.

LINDER, D.H. 1942. A contribution towards a monograph of the genus *Oidium*. Lloydia 5: 165-207.

MELZER, V. 1924. L'ornamentation des spores des *Russules*. Bull. Soc. Mycol. France 40: 78-81.

ROGERS, D.P. 1935. Notes on the lower Basidiomycetes. Univ. Iowa Stud. 17: 1-43.

TALBOT, P.H.B. 1965. Studies of *Pellucularia* and associated genera of Hymenomycetes. Persoonia 3: 371-406.

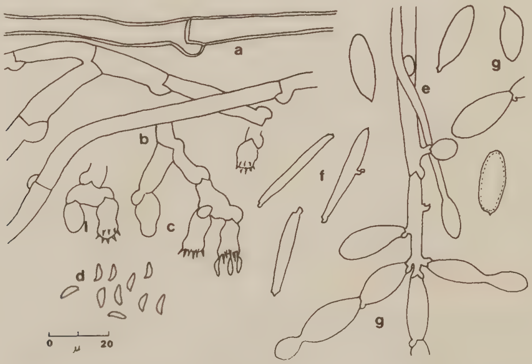


Fig. 1a-g. a-Subicular hyphae. b-Subhymenial hyphae. c-Basidia. d-Basidiospores. e-Conidiophores. f-Fragmented conidiophores. g-Conidia (From holotype FP135881)

MYCOTAXON

Volume LX pp. 433-442 October-December 1996

PLANISTROMELLACEAE, A NEW FAMILY IN THE DOTHIDEALES

MARGARET E. BARR

9475 Inverness Road, Sidney, British Columbia, Canada V8L 5G8

SUMMARY

The new family Planistromellaceae is presented to include taxa having ascostromata, interthecial tissues, and schizogenously formed, periphysate ostioles. Members of the family are species of *Planistromella*, *Planistroma*, *Loratospora*, the new genus *Eryptio*, *Microcyclus*, and *Mycosphaerellopsis*. New combinations are proposed for *Planistromella yuccigena*, *P. acervata*, *P. parryi*, *Eruptio acicola*, *E. pini*, and *Microcyclus kawagoeii*.

Several genera have been described recently as members of the Dothideales (s. str.), but do not fit in any known family. These fungi resemble members of the Pseudosphaeriaceae in the formation of multiloculate or uniloculate ascostromata composed of brown, pseudoparenchymatous cells, in lacking any true peridial structure, and in the presence of interthecial tissues surrounding the basal layer of asci. The locules open schizogenously by a periphysate ostiole, rather than by a simple, lysigenous pore or by dehiscence of a caplike structure. The asci, ascospores, and anamorphs are quite similar to those of species in the Dothideaceae (Mycosphaerellaceae), but in those taxa the interthecial tissues are less extensive and the apical pore is formed lysigenously. For these genera, and a group of other taxa whose ostioles and locules are similar, a new family must be erected. The diagnosis of the family follows, with notes on the genera that constitute it at this time.

Planistromellaceae M.E. Barr, fam. nov.

Ascostromata multiloculata vel uniloculata immersa vel erumpentia pseudoparenchymata. Ostiola schizogena periphysata. Asci bitunicati fissitunicati basali oblongi vel saccati. Cellula interthecialia. Ascosporae hyalinae vel fuscae aseptatae vel septatae. Status anamorphosus pycnidia vel acervuli vel sporodochia, conidia holoblastica hyalina vel fusca aseptata vel septata. Status spermogonicus pycnidia, spermatia phialidica hyalina aseptata. Genus typicus: *Planistromella* A.W. Ramaley.

Ascostromata multiloculate or uniloculate, immersed to erumpent, composed of brown, pseudoparenchymatous cells; locules small, opening by schizogenously formed, periphysate ostioles. Asci bitunicate, fissitunicate, oblong or saccate, in basal layer, often interspersed with and overtopped by cellular remnants of interthecial tissues. Ascospores hyaline or lightly pigmented, yellowish to brownish, aseptate or one to several transversely septate; wall thin, smooth, occasionally surrounded by gel coating; contents guttulate. Anamorphs where known forming pycnidia, locules or acervuli in stroma or bearing conidia over stroma surface prior to locule formation; conidiogenous cells short, conidiogenesis holoblastic; conidia hyaline to brown, aseptate or one to several transversely septate; wall smooth or verruculose, bearing one or more apical appendages at times. Spermatial state developing in the same or separate locules; conidiogenesis phialidic; spermatia minute. hyaline, aseptate. Biotrophic, hemibiotrophic, or maturing in dead tissues. Type genus: *Planistromella*.

Planistromella A.W. Ramaley (Mycotaxon 47: 260. 1993) has as the type species *P. yuccifoliorum* A.W. Ramaley; it forms biseptate ascospores. The anamorph, *Kellermania yuccifoliorum* A.W. Ramaley, develops in the same or similar stroma as the ascomatal locules, and spermatia may be produced from phialides in the conidiogenous locule. In her studies elucidating the diverse fungi that inhabit leaves of members of the Agavaceae, Ramaley (1993, 1995) has described two additional species of *Planistromella*, each forming uniseptate ascospores, and their anamorphs. The second species, *P. uniseptata* A.W. Ramaley, has as anamorph *Kellermania yuccigena* Ellis & Everh. The third species, *P. torsifoliorum* A.W. Ramaley, has as anamorph *K. uniseptata* (Morgan-Jones, Nag Raj & W.B. Kendr.) Nag Raj. Three more species are added to the genus, each in leaves of members of Agavaceae. An anamorph is linked circumstantially to the first and second of these species.

Planistromella yuccigena (M.E. Barr) M.E. Barr, comb. nov.
Basionym: *Wettsteinina yuccigena* M.E. Barr, Contr. Univ. Michigan Herb. 9: 547. 1972. Shoemaker and Babcock (1987) redescribed and illustrated this taxon which they rightfully excluded from *Wettsteinina*, but without suggesting any possible disposition. The species fits well in *Planistromella*; the possible anamorph associated in the same leaves is *Kellermania anomala* (Cooke) Höhn.

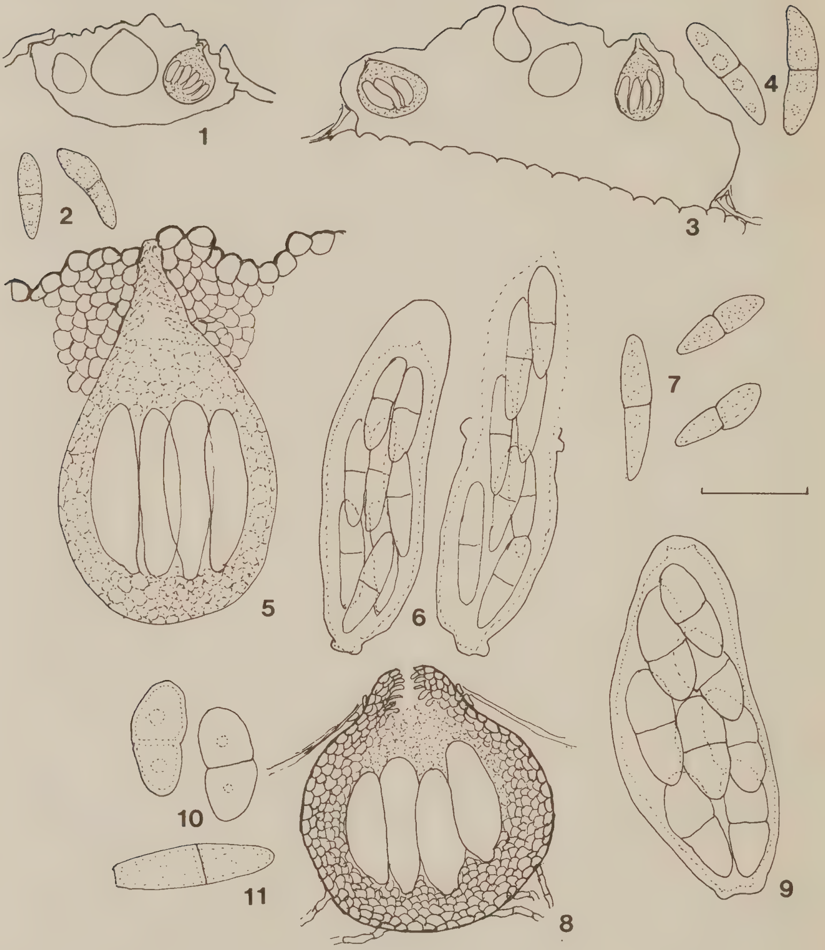
Planistromella acervata (Ellis & Everh.) M.E. Barr, comb. nov. Figs. 1, 2.
Basionym: *Diatrype acervata* Ellis & Everh., J.

Mycol. 4: 75. 1888. Ellis and Everhart (1892) had transferred the species to *Diaporthe*, but Wehmeyer (1933) excluded it. Barr (1972) placed it in *Mycosphaerella*, although the periphysate ostiole negates that disposition. This 'species' may in fact represent a species complex. Ramaley (pers. communication) has provided several interesting observations. Ascospore sizes vary: 15-20 x 3-4 µm for the New Jersey collection on *Yucca filamentosa* L. (NAF 2124, NY), 14-16 x 3-4.5 µm for a collection on *Y. glauca* Nutt. from North Dakota (Brenckle, F. Dakot. 438, NY), 18-22 x 4-5 µm for a collection on *Yucca* sp. from California (as *Plowrightia circumscissa* Tracy & Earle, NY), and (19-)21.5-29.5(-32) x 5-6.5 µm for Colorado collections. A *Stigmina* anamorph develops over immature stromata of the Colorado specimens, and spermatia form in shallow cavities in the stroma. This is similar to the situation in *Mycosphaerella deightonii* M. Morelet, as described by Sivanesan (1984), where spermatia and conidia of *Stigmina concentrica* (Cooke & Ellis) Deighton form in or on the stroma. In that species the ascospores are small, 14.5-17 x 3.5-4 µm, and conidia are narrower and paler than those Ramaley found in her collections. Additional studies on these variations should prove instructive.

Planistromella parryi (Farl. in Cooke) M.E. Barr, comb. nov. Figs. 3, 4.

Basionym: *Endothia parryii* Farl. in Cooke, Grevillea 13: 102. 1885. The fungus had been assigned to *Plowrightia* by Rehm (1908) and to *Dothidella* by Theissen and Sydow (1915). Because of the reddish pigmentation of stromatic tissues and the periphysate ostioles of locules, the species has also been described as *Hypocrea agaves* Maubl. (Bull. Soc. Mycol. France 19: 292. 1903), later transferred to *Plowrightia agaves* (Maubl.) Maubl. (Bull. Soc. Mycol. France 23: 143. 1907). Another name is *Plowrightia williamsoniana* Kellerm., J. Mycol. 12: 185. 1906. Rehm (1908) and Theissen and Sydow (1915) indicated that all the names refer to one species, which develops in margined spots in leaves of species of *Agave* and *Fourcroya* in southeastern USA, Puerto Rico, Mexico, and Guatemala.

Planistroma A.W. Ramaley (Mycotaxon 42: 69. 1991) was erected for *P. yuccigenum* A.W. Ramaley, a species similar in stromata and substrate to those of *Planostromella*. The stromata are usually occupied in succession by conidiogenous locules, wherein the conidia of the anamorph *Piptarthron pluriloculare* A.W. Ramaley are holoblastically formed, by spermatia produced from phialides in the upper regions of the locule or in separate locules, and by ascigerous locules. The ascospores are unicellular. Ramaley (1992, 1995) has described two additional species differing in ascospore size and shape, and in their anamorphs: *Planistroma obtusilunatum* A.W. Ramaley and its



Figs. 1-11. Members of Planistromellaceae. 1, 2. *Planistromella acervata*: 1, outline of stroma, 2, ascospores. 3, 4. *P. parryi*: 3, outline of stroma, 4, ascospores. 5-7. *Microcyclus kawagoeii*: 5, locule in stroma, 6, asci, 7 ascospores. 8-11. *Mycosphaerellopsis myricariae*: 8, ascoma in vertical section, 9, ascus, 10, ascospores, 11, conidium. Standard line = 150 μm for 1, 3; 30 μm for 5, 8; 15 μm for 2, 4, 6, 7, 9-11.

anamorph *Piptarthron uniloculare* A.W. Ramaley and *Planistroma nolinae* A.W. Ramaley and its anamorph *Piptarthron crassisporum* A.W. Ramaley. All three species develop in leaves of Agavaceae.

Loratospora Kohlm. & Volkm.-Kohlm. (Syst. Ascomyc. 12: 10. 1993) was described for *L. aestuarii* Kohlm. & Volkm.-Kohlm. (1993), a halotolerant fungus in culms of *Juncus roemerianus* Scheele. From the description and illustrations of this fungus, it is a charter member of the new family, although no anamorph is known.

One of the early photographs of a fungus exhibiting the features that distinguish the family is that by Luttrell (1973, fig. 6b) of *Scirrhia acicola* (Dearn.) Sigg. (*Mycosphaerella dearnessii* M.E. Barr 1972). This species is the cause of the brown-spot needle blight of pines, better known as *Lecanosticta* needle blight for the anamorph *Lecanosticta acicola* (Thüm.) Syd. Its close relative *Mycosphaerella pini* Rostr. apud Munk (*Scirrhia pini* A. Funk & A.K. Parker), the red-band needle blight or *Dothistroma* needle blight with anamorph *Dothistroma septospora* (Dorog.) M. Morelet is another widespread species. Because of the diseases they cause, these species have been much investigated. The study by Evans (1984) on Central American collections provides many details on the history and morphology of these taxa, as well as on *M. gibsonii* H.C. Evans (not seen so not treated further here). When these two species are removed from *Mycosphaerella*, as they must be, a new genus is needed to accommodate them.

Eruptio M.E. Barr, gen. nov.

Ascostromata multiloculata vel uniloculata elongata erumpentia pseudoparenchymatica. Loculi minimi, ostioli periphysati. Asci bitunicati basali oblongi vel saccati, celluli intertheciali crescentia et compressi. Ascosporae hyalinae didymae oblongae vel fusiformes. Conidia in acervuli, holoblastica, hyalina vel fusca fusiformia vel cylindrica vel filiformia septata. Spermatia hyalina aseptata. Sp. typicus: *Oligostroma acicola* Dearn.
Etymology: from the bursting forth of ascostromata from the substrate.

Ascostromata multiloculate or uniloculate, elongate, erumpent from substrate, pseudoparenchymatous, cells reddish or dark brown, hyphae abundant in leaf tissues. Locules small, ostioles schizogenously formed, periphysate. Asci functionally bitunicate, oblong to saccate, basal, pushing into and compressing interthecial cells. Ascospores hyaline, oblong fusoid, one septate; wall smooth; minutely guttulate. Anamorphs forming acervuli in upper regions of stromata. Conidia holoblastic, hyaline to brown, fusoid to cylindric to filiform, septate.

Spermatia phialidic, hyaline,aseptate.

Eruptio acicola (Dearn.) M.E. Barr. comb. nov.
Basionym: *Oligostroma acicola* Dearn., Mycologia 19: 251. 1926.

Eruptio pini (Rostr. apud Munk) M.E. Barr, comb. nov.
Basionym: *Mycosphaerella pini* Rostr. apud Munk, Dansk Bot. Ark. 17(1): 312. 1957.

Microcyclus Sacc. in Syd. & P. Syd. (Ann. Mycol. 2: 165. 1904) must also be arranged in the Planistromellaceae, for Theissen and Sydow (1915) and Müller and Sanwal (1954) described periphyses in the ostioles of the type species, *M. angolensis* Sacc., Syd. & P. Syd. That fungus is biotrophic in leaves of *Milletia* (Fabaceae) in Africa. A better known species is *M. tinctoria* (Tul.) Arx in E. Müll. & Arx (1962), biotrophic on species of *Baccharis* (Asteraceae) in Central and South America. This species has an anamorph known as *Pazschkeella brasiliensis* Syd. that forms pycnidial cavities in the stroma. The short conidiogenous cells that line the cavity form aseptate, hyaline conidia holoblastically. Several other species have been described in the genus, biotrophic in tropical and subtropical regions. Cannon et al. (1995) transferred another species as *Microcyclus porlieriae* (Rehm) P.K. Cannon, Carmarán & A.I. Romero, and provided a key to South American species.

Another species should be added, from leaves of *Prunus* (Rosaceae) in warm temperate regions of Japan. This species was present on a specimen sent to the University of Massachusetts phanerogamic herbarium, and the infected leaves were brought to my attention by the late Harry Ahles. Dr. K. Katumoto kindly furnished me with parts of two collections of this fungus from YAM, with correction of spelling for the specific epithet, and with notes and translations from the Japanese description. Additional probable synonyms include: *Coccoidea tsurudae* Hara, Bull. Shizuoka Pref. Agric. Soc. 247: 1. 1918, *Coccoidella tsurudae* (Hara) Hara, Jubyogaku-kekuron 82. 1923, and *Coccoidella spinulosae* (Henn.) Hara, Nippon-gaikingaku 169. 1936. The latter name is based on *Diplodina spinulosae* Henn. (Hedwigia 43: 145. 1904), a conidial fungus that may be the anamorph of *Microcyclus kawagoeii*. *Coccoidella* is a stromatic member of the Dothideaceae (Barr 1987) whose ascomatal locules open by a lysigenous pore.

Microcyclus kawagoeii (Hara) M.E. Barr, comb. nov. Figs. 5-7.
Basionym: *Polystomella kawagoii* Hara, Bot. Mag. Tokyo 29: 51. 1915.
Additional synonym: *Coccoidella kawagoii* (Hara) Hara,

Jubyogaku-kakuron, 85. 1923.

Ascostromata widely erumpent from central basal hypostroma, 0.5-1 mm wide, composed of pseudoparenchymatous cells, brown hyphae within leaf tissues; locules numerous over entire exposed surface, 65-90 µm wide, 90-130 µm high; ostiole periphysate. Asci in basal layer, 35-70 x 10-12 µm, few pseudoparenchymatous cells remaining above. Ascospores hyaline, obovoid, 12-18(20) x 3-5 µm, one septate, slightly supramedian, upper cell shorter and wider than lower; wall smooth; contents guttulate. In leaves of *Prunus spinulosa* Sieb. & Zacc. and *P. zippeliana* Miquel., Japan. Material examined: *P. spinulosa*,Yamaguchi Pref. Takamizu-mura, Kumage-gum, 10 Feb 1952, I. Hino ex YAM 20168 (NY); *P. zippeliana* Miquel., Honshu, Pref. Chiba, Honshu, 3 Apr 1980, H. Tobe, ex MASS (NY); *P. zippeliana* (immature), Kyushu, Kagoshima Pref. Mt. Takakuma, 2 Nov 1941, S. Wakabayoshi. ex YAM 20166 (NY).

Mycosphaerellopsis Höhn. (Ann. Mycol. 16: 157. 1918). Other taxa that show similar anatomy and form the periphysate ostioles schizogenously produce uniloculate ascomata as immersed biotrophs in leaf tissues. *Sphaeria myricariae* Fuckel has been assigned variously as *Sphaerella myricariae* (Fuckel) Sacc. (Saccardo 1882), *Mycosphaerella myricariae* (Fuckel) Lindau (Arx 1949), or *Didymella myricariae* (Fuckel) Petrak (Petrak 1923, Müller and Arx 1962, Barr 1972, Eriksson & Hawksworth 1993), or relegated as a synonym of *Pseudosphaerella* Hohn. (Clements and Shear 1931). This fungus is the type species of a distinctive genus *Mycosphaerellopsis* that presently includes only *M. myricariae* (Fuckel) Höhn. (Figs. 8-11). Höhnel (1918) considered it to belong in the Pseudosphaeriaceae, because of the abundant interthecial cells remaining between and above the maturing asci. The immersed, uniloculate ascostromata in leaves of *Myricaria* (Tamaricaceae) in Europe form darkened apices that bear a few short hyphae, and open by periphysate ostioles. The oblong to saccate asci are basal and contain light yellowish, broadly obovoid, one-septate ascospores, 14-20 x 5-6 µm. An associated pycnidial anamorph is also present in the leaves; the short conidiogenous cells are holoblastic, producing hyaline, oblong, uniseptate conidia, 22.5-29 x 5-6.5 µm.

Luttrell (1973) mentioned three other taxa that form ostiolar periphyses and lack pseudoparaphyses. All three form a hamathecium composed of short periphysoids that arise from the upper regions of the peridium and extend as periphyses in the ostiole. *Metacapnodium juniperi* (W. Phillips & Plowr.) Speg. is the type of the genus and of Metacapnodiaceae (Hughes & Corlett in Hughes 1972), in the Chaetothyriales (Barr 1987). *Plurisperma dalbergiae* Sivan. is regarded as a species of *Muellerella*, *M. dalbergiae* (Sivan.) Arx & E. Müll. (1975) in the

Verrucariales. *Mycosphaerella ascophylli* Cotton differs from typical species of *Mycosphaerella* in forming both a periphysate ostiole and narrow periphysoids from the upper peridium (Kohlmeyer and Kohlmeyer 1979). These may appear to be pseudoparaphyses in squash mounts. This taxon is a widely distributed mycophycobiont in which the algae *Ascophyllum nodosum* (L.) Le Jol. and *Pelvetia canaliculata* DC. & Thuret are never found without the fungus at maturity (Webber 1967). A similar situation occurs with *M. apophlaeae* Kohlm. in Kohlmeyer and Demoulin (1981) in two species of the endemic red alga *Apophlaea* from New Zealand (Kohlmeyer and Hawkes 1983). The combination of characteristics presented indicates that another genus must be erected, which probably should be arranged in the Verrucariales.

The genera here assigned to the Planistromellaceae may be separated by use of the following key.

1. Ascospores aseptate; ascostromata usually multiloculate, weakly biotrophic or saprobic in Agavaceae........ *Planistroma*
1. Ascospores septate...................................2
    2. Ascospores elongate, three-septate; ascostromata uniloculate in dead culms of *Juncus*.......*Loratospora*
    2. Ascospores one- or two-septate..................3
3. Ascospores broadly obovoid; ascomata uniloculate in living or dying leaves of *Myricaria*....*Mycosphaerellopsis*
3. Ascospores narrower, oblong to fusoid; ascostromata usually multiloculate.................................4
    4. Ascostromata widely erumpent, biotrophic in leaves and stems of various plants.............*Microcyclus*
    4. Ascostromata less erumpent, biotrophic, hemibiotrophic or saprotrophic..........................5
5. Biotrophic in leaves of *Pinus*..................*Eruptio*
5. Biotrophic, hemibiotrophic or saprotrophic in Agavaceae *Planistromella*

Acknowledgments

I thank Drs. J. Kohlmeyer and A.W. Ramaley who kindly reviewed the manuscript and offered constructive criticism in the process.

Literature Cited

Arx, J.A. von. 1949. Beitrage zur Kenntnis der Gattung *Mycosphaerella*. Sydowia 3: 28-100.

_____, and E. Müller. 1975. A re-evaluation of the bitunicate Ascomycetes with keys to families and genera. Stud. Mycol. (Baarn) 9: 1-159.

Barr, M.E. 1972. Preliminary studies on the Dothideales in temperate North America. Contr. Univ. Michigan Herb. 9: 523-638.

_____. 1987. Prodromus to Class Loculoascomycetes. Published by the author, Amherst, MA. 168 p.

Cannon, P. F., C.C. Carmarán and A.I. Romero. 1995. Studies on biotrophic fungi from Argentina: *Microcyclus porlieriae*, with a key to South American species of *Microcyclus*. Mycol. Res. 99: 353-356.

Ellis, J.B., and B.M. Everhart. 1892. The North American Pyrenomycetes. Published by the authors, Newfield, NJ. 793 p.

Eriksson, O.E., and D.L. Hawksworth. 1993. Outline of the Ascomycetes - 1993. Syst. Ascomyc. 12: 51-257.

Evans, H.C. 1984. The genus *Mycosphaerella* and its anamorphs *Cercoseptoria*, *Dothistroma* and *Lecanosticta* on pines. Mycol. Pap. 153: 1-102.

Höhnel, F. von. 1918. Mycologische Fragmente Nrn. 191-290. Ann. Mycol. 16: 35-174.

Hughes, S.J. 1972. New Zealand fungi 17. Pleomorphism in Euantennariaceae and Metacapnodiaceae, two new families of sooty moulds. New Zealand J. Bot. 10: 225-242.

Kohlmeyer, J., and V. Demoulin. 1981. Parasitic and symbiotic fungi on marine algae. Bot. Marina 24: 9-18.

_____, and M.W. Hawkes. 1983. A suspected case of mycophycobiosis between *Mycosphaerella apophlaeae* (Ascomycetes) and *Apophlaea* spp. (Rhodophyta). J. Phycol. 19: 257-260.

_____, and E. Kohlmeyer. 1979. Marine Mycology. The higher fungi. Academic Press, NY. 690 p.

_____, and B. Volkmann-Kohlmeyer. 1993. *Atrotorquata* and *Loratospora*: New ascomycete genera on *Juncus roemerianus*. Syst. Ascomyc. 12: 7-22.

Luttrell, E.S. 1973. Loculoascomycetes. Ch. 7, pp. 135-219. In: The Fungi, vol. IVA. Eds. G.C. Ainsworth, F.K. Sparrow and A.S. Sussman. Academic Press, NY.

Müller, E., and J.A. von Arx. 1962. Die Gattungen der didymosporen Pyrenomyceten. Beitr. Kryptogamenfl. Schweiz 11(2): 1-922.

_____, and B.D. Sanwal. 1954. Über die Gattungen *Microcyclus* Sacc., *Coccoidella* v. Höhn., *Coccodothis* Theiss. et Syd. und *Coccodothella* Theiss. et Syd. Sydowia 8: 231-244.

Petrak, F. 1923. Mykologisches Notizen. 199. Über *Didymella*, *Mycosphaerellopsis* und verwandte Gattungen. Ann. Mycol. 21: 19-30.

Ramaley, A. 1991. Fungi of *Yucca baccata 1. Piptarthron pluriloculare* and its teleomorph, *Planistroma yuccigena*. Mycotaxon 42: 63-75.

_____. 1992. Fungi from *Yucca baccata. 2. Planistroma obtusilunatum* sp. nov., and its anamorph *Piptarthron uniloculare* sp. nov. Mycotaxon 45: 449-460.

_____. 1993. New fungi from *Yucca: Planistromella yuccifoliorum, gen. et sp. nov., its anamorph, Kellermania yuccifoliorum*, sp. nov., and

Planistromella uniseptata, sp. nov., the teleomorph of *Kellermania yuccigena*. Mycotaxon 47: 259-274.

_____. 1995. New species of *Kellermania*, *Piptarthron*, *Planistroma*, and *Planistromella* from members of the Agavaceae. Mycotaxon 50: 255-268.

Rehm, H. 1908. Ascomycetes novi. Ann. Mycol. 6: 313-325.

Saccardo, P.A. 1882. Sylloge Fungorum. Patavia. 766 p.

Shoemaker, R.A., and E.C. Babcock. 1987. *Wettsteinina*. Canad. J. Bot. 65: 373-405.

Sivanesan, A. 1984. The bitunicate Ascomycetes and their anamorphs. Cramer, Vaduz. 701 p.

Theissen, F., and H. Sydow. 1915. Die Dothideales. Ann. Mycol. 13: 149-746.

Webber, F.C. 1967. Observations on the structure, life history and biology of *Mycosphaerella ascophylli*. Trans. Brit. Mycol. Soc. 50: 583-601.

Wehmeyer, L.E. 1933. The genus *Diaporthe* Nitschke and its segregates. Univ. Michigan Stud. Sci. Ser. 9: 1-349.

MYCOTAXON

Volume LX, pp. 443-448 October-December 1996

A NEW SPECIES OF *ALYSIDIOPSIS* FROM MEXICO.

Angel Mercado Sierra[1], Maria José Figueras[2], Julio Mena Portales[1]

[1]Instituto de Ecología y Sistemática, Academia de Ciencias de Cuba. AP 8010, Ciudad de la Habana 10800, Cuba. [2]Facultad de Medicina, Universidad Rovira i Virgili, Carrer Sant Llorenç 21, 43201 Reus, España.

ABSTRACT

Alysidiopsis lignicola spec. nov. isolated from decayed wood in Mexico is described and illustrated with light and scanning electron microscopy. We provide a comparative discussion with the other 3 species known inside this genus and include a key with all taxa of ***Alysidiopsis*** Sutton.

Key words: ***Alysidiopsis, Alysidiopsis lignicola***, Taxonomy, Hyphomycetes, dead wood, México.

RESUMEN

Se describe e ilustra con microscopía óptica y electrónica de barrido ***Alysidiopsis lignicola*** spec. nov. aislada a partir de madera en descomposición en Méjico. Se compara y discute esta especie con las otras tres descritas dentro del género. Se incluye una clave dicotómica para la clasificación de todas las especies de ***Alysidiopsis*** Sutton.

Palabras clave: ***Alysidiopsis, Alysidiopsis lignicola***, Sistemática, Hifomicetes, madera en descomposición, México.

INTRODUCTION

During a survey of microscopic fungi collected on leaves and plant debris in several places of Veracruz State, Mexico, the senior author found an interesting hyphomycete which colonizes the bark of dead trunks near the sea in the Gulf of Mexico. From light microscopy and a literature survey we believe we are dealing with a new anamorph species. Scanning microscopy was employed to obtain further details of the conidiogenous cells. These studies allow us to classify this taxon as a new species of ***Alysidiopsis*** Sutton (1973). The type species is ***A. pipsissewae*** Sutton. At present this genus includes two other species, ***A. foliicola*** Castañeda & Arnold, and ***A. yunnanensis*** L. Guo & X.L. Liu.
The type of this new species is deposited in the Mycological Herbarium of the Academy of Sciences of Cuba (HACM).

TAXONOMY

Alysidiopsis lignicola Mercado, Figueras et Mena sp. nov. Fig. 1-6
Coloniae effusae, atrobrunneae, pilosae. Mycelium partim superficiale et partim in substrato immersum, ex hyphis pallide brunneis, septatis, ramosis, laevibus, 2-2,5 mm crassis compositum. Conidiophora macronematos, recta vel flexuosa, septata, laevia, brunnea vel atro brunnea, abrupte pallidissima vel fere subhyalina et irregulariter ramosa ad apicem, 100-200 x 10-15 µm ad basim, 5-7 µm crassis supra basim, 3-4,5 µm ad apicem, parietibus crasis; rami breves parietibus tenuibus, 4-20 x 2,5-4 µm, terminales vel laterales, pallide brunnei vel subhyalinis, septati vel aseptati; teretes, cupiformibus vel ampulliformibus. Cellulae conidiogenae polyblasticae, integratae, terminalesque vel in ramis discretae, interdum conidia exorientae, denticulatae; dentes validi, lati, aliquante fuscati ad apicem, 1-1,5 µm alti. Conidia in dentium apice disposita, solitaria vel in brevibus catenis posita, sicca, elipsoidalia, claviformia, citriformia, ovalia vel aliquantum irregularia, valida cicatrice fusca ad basim notata, rotundata ad apicem, subhyalina, laevia, transversaliter 0-1 septata, 3-8 x 1,5-2,5 µm.

Holotypus: In cortice emortuis arboris ignotae. Costa Esmeralda, Veracruz, Mexico, coll. A. Mercado 15 VIII. 1993, (HACM 9111).
Colonies effuse, dark brown, hairy. Mycelium partly superficial and partly immersed, consisting of smooth, pale brown, septate hyphae 2-2,5 µm wide. Conidiophores macronematous, straight or flexuous, septate, smooth, branched towards the apex, brownish to dark brown, thick-walled, becoming almost abruptly subhyaline towards the apex were it ramifies in a complex manner to give rise to terminal and lateral, short, branches which can produce conidiogenous cells directly. Conidiophores 100-200 x 10-15 µm (at the base), 5-7 µm above the base and 3-4,5 µm towards the apex. Branches thin-walled, 4-20 x 2.5-4 µm of two types 1) pale brown, cylindrical and septate and 2) subhyaline, aseptate, ampulliform or barrel-shaped. Conidiogenous cells polyblastic, integrated and terminal or discrete on branches, with many denticles, slightly darker at the top

where conidia are produced; they can give rise to new conidiogenous cells. Denticles 1-1.5 µm high. Conidia solitary or in short chains, dry, ellipsoidal, clavate, limoniform, ovate or slightly irregular, with a dark, pronounced scar at the base and a rounded apex, subhyaline, smooth, 3-8 x 1.5-2.5 µm, septa 0-1.

Holotype: On bark of dead trunk by the sea. Esmeralda Coast, Veracruz, Mexico, coll. A. Mercado. 15 Aug. 1993, (HACM 9111).

All the species of ***Alysidiopsis*** are characterized by possess macronematous conidiophores irregularly branched near the apex, blastic and denticulate conidiogenous cells, and usually catenate conidia very variable in shape and septation.

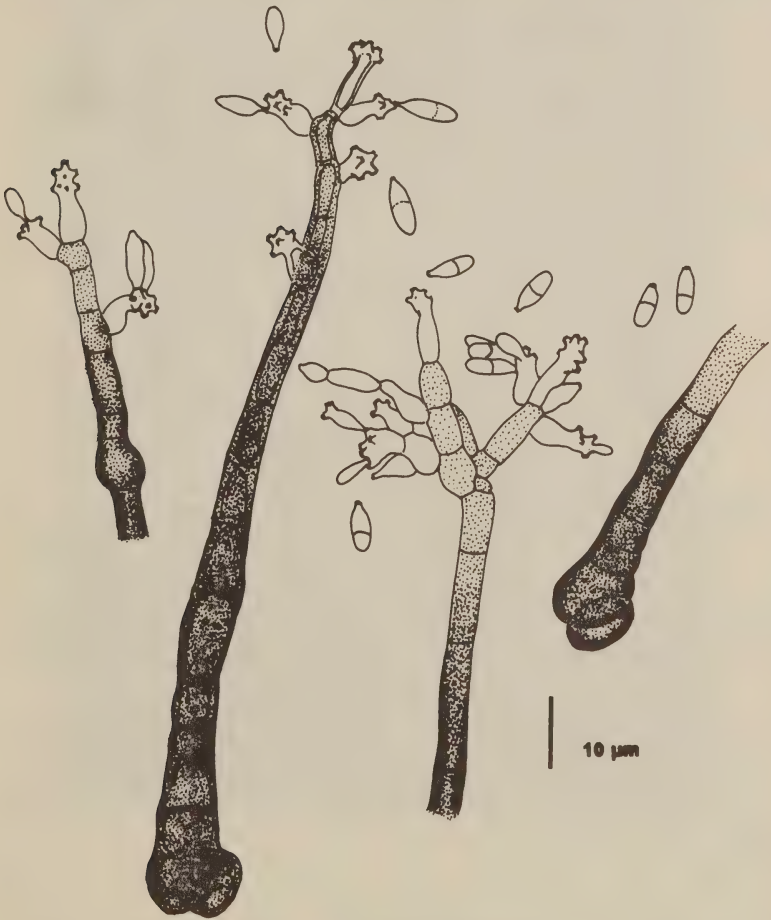


Fig. 1.- *Alysidiopsis lignicola* (HACM 9111)

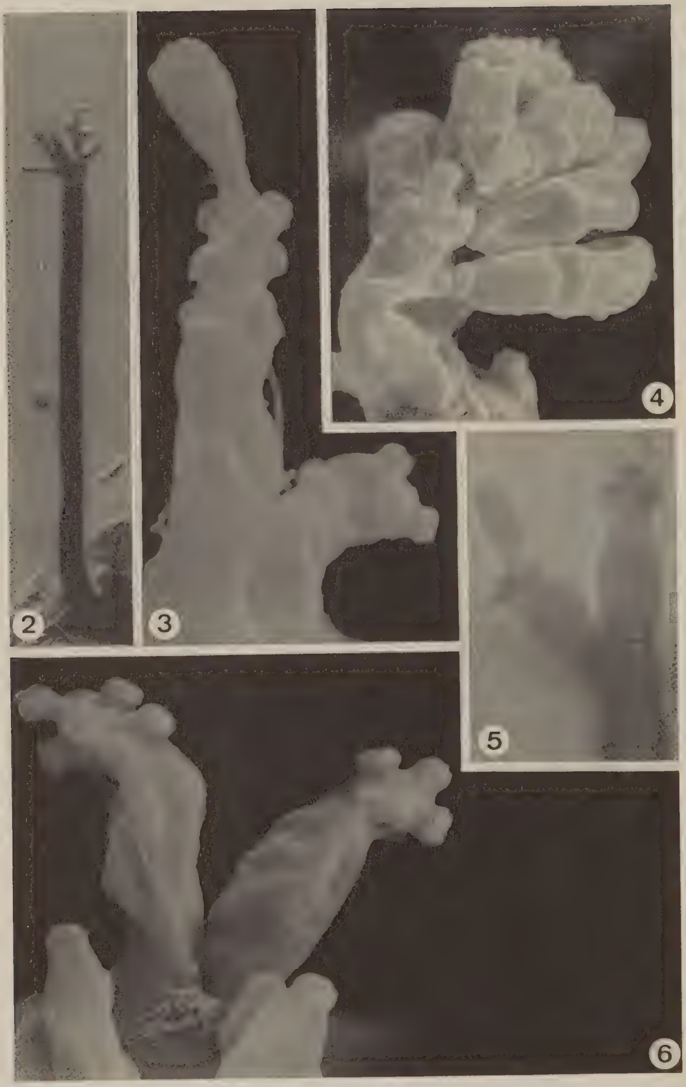


Fig. 2-6.- *Alysidiopsis lignicola* (HACM 9111). 2. x250; 3. x6000; 4. x7500; 5. x1200; 6. x9000.

The species here described, **A. lignicola**, is proposed as new because of the peculiar colour, shape, size, and arrangement of the conidiophore branches and conidiogenous cells, and also by the shape and size of its conidia. These characters clearly separate this taxon from the other three known species in this genus as seen in the taxonomic key provided. **A. pipsissewae** Sutton, the type species, collected on peduncular hairs of **Chimaphila umbellata** var. **occidentalis** in Canada (Sutton, 1973), has brown conidiophores only slightly paler near the apices and measuring 120-170 x 10-12 µm at the base, (5-8 µm wide at the apex). Conidia are pale brown, but darker towards the ends, 5-13 x 3.5-5.5 µm. **A. foliicola** Castañeda & G. Arnold, collected on fallen leaves of **Calophyllum calaba**. in Cuba (Arnold & Castañeda, 1986) features short and narrow conidiophores up to 50 x 4-5 µm (at base) and 0-septate mostly cylindrical to doliiform conidia, brown in the middle and subhyaline at the ends, 5.5-80 x 2-3 µm. More recently Guo & Liu (1992) described **A. yunnanensis** L. Guo & X.L. Liu, collected on leaves of two species of **Eupatorium**, **E. odoratum** and **E. colestinum** L. in China. This taxon is characterized by conidiophores up to 440 x 4.3-7.6 µm and conidia 5.4-26.0 x 5.4-17.3 µm with 0-3 longitudinal or oblique septa.

A further comparative study of the species of **Alysidium** and **Alysidiopsis** with those of **Cladosporium** complex is necessary since all these genera are very similar.

KEY TO THE SPECIES OF *ALYSIDIOPSIS*

Conidia with transverse, longitudinal or oblique septa, 5.4-26.0 x 5.4-17.3 µm .... **A. yunnanensis**

Conidia with 0-1 transverse septa.. 1

1a. Conidiophores short, up to 50 µm long. Conidia always 0-septate, unequally coloured. .... **A. foliicola**
1b. Conidiophores over 100 µm long. Conidia 0-1 septate. 2

2a. Conidiophores brown and only slightly paler near the apex, 120-170 x 10-12 µm at the base, (5-8 wide at the apex). Conidia pale brown, darker towards the ends; 5-13 x 3.5-5.5 µm .... **A. pipsissewae**
2b. Conidiophores brown becoming almost subhyaline abruptly towards the apex, 100-200 µm x 10-15 µm at the base and 3.0-4,5 µm towards the apex. Conidia subhyaline; 3-8 x 1.5-2.5 µm... **A. lignicola**

ACKNOWLEDGEMENTS

Angel Mercado is grateful to Gabriela Heredia M. Sc. (Instituto de Ecología, Xalapa, Mexico) for her aid in collecting this fungus and for providing research facilities in her laboratory during part of this work. We all thank Dr. Pedro Herrera (Instituto de Ecología y Sistemática, Havana, Cuba) for correcting the Latin diagnoses and Dr. Enrique Descals for revision of the manuscript. This study was partly supported by Fundació Ciència i Salut.

REFERENCES

Arnold, G.R.W. & R.F. Castañeda. (1986). Neue Hyphomyzeten-Arten aus Kuba. **Feddes Repert,** 97(1-2): 79-88.

Guo, Y.L. & X.J. Liu. (1992). ***Alysidiopsis yunnanensis***, a new species of the genus ***Alysidiopsis***. **Acta Mycol. Sinica**, 11(3): 213-215.

Sutton, B.C. (1973). Hyphomycetes from Manitoba and Saskatchewan. **Mycol. Pap.,** 132: 1-143.

MYCOTAXON

Volume LX, pp. 449-454 October-December 1996

NEW AND INTERESTING *HELICOON* SPECIES FROM SPAIN

Samir K. Abdullah[1], J. Guarro[2] and M.J. Figueras[2]

[1]Biology Department, College of Science, University of Basrah, Iraq, [2]Unitat de Microbiologia, Facultat de Medicina i Ciències de la Salut, Universitat Rovira i Virgili, 43201 Reus, Spain.

ABSTRACT

Helicoon microsporum sp. nov. and ***H. fuscosporum***, a new record for Spain, found during a survey of aero-aquatic conidial fungi in Northern Catalunya, are described and illustrated.

RESUMEN

Se describen e ilustran ***Helicoon microsporum*** y ***H. fuscosporum***, un nuevo registro para España. Dichas especies fueron aisladas durante un estudio sobre los hongos conidiales aero-acuáticos realizados en España.

INTRODUCTION

In a survey of aero-aquatic conidial fungi in a static water habitat and streams surrounded by deciduous and coniferous trees in Northern Catalunya, Spain, two species, assigned to the genus *Helicoon* Morgan, were encountered. One is a new species of *Helicoon*, the other is *H. fuscosporum* Linder, a new record for Spain. The description of the new fungus is based on its growth and sporulation on decaying pine twigs incubated in moist chamber, because attempts in isolating it in artificial culture media were unsuccessful.

MATERIALS AND METHODS

Samples of leaves and twigs of deciduous and coniferous trees were collected from a variety of stagnant water habitats and streams in different localities in Northern Catalunya, Spain. These samples were washed several times with tap water and then placed on filter papers moistened with water in 15 cm. Petri dishes and incubated at 15°C under light. Glistening white or coloured propagules with helicoid shape appeared on the exposed surface within 4 to 6 days.

TAXONOMY

Helicoon microsporum Abdullah, Guarro et Figueras, sp. nov . (Figs. 1-2)

Coloniae in substrato naturali Pini sp., inconspicuae, albae; mycelium superficiale hyphis hyalinis, ramosis, septatis, 2.5-3.0 µm latis, compositum. Conidiophora micronematosa vel semimacronematosa, simplicia, raro septata, recta vel flexuosa, hyalina, laevia, brevia, 5-20 x 3-4 µm. Cellulae conidiogenae blasticae, integratae, determinatae, denticulatae. Conidia solitaria, acrogena, sicca, hyalina, helicoidea, cum 3-6 spiris (pleraque cum 4-5 spiris), globosa vel subglobosa, 15-17 x 16-20 µm. Filamentum conidiale hyalinum, septatum (4-6 septa in unaquaque spira), sine constrictionibus in septis.
Holotypus: IMI 370113.

Colonies on rotten twig of *Pinus sp.* inconspicuous, white; mycelium superficial composed of hyaline, branched, septate hyphae 2.5-3.0 µm wide. Conidiophores micronematous to semimacronematous, simple, rarely branched, straight or flexuous, hyaline, smooth, short, 5-20 µm long and 3-4 µm wide. Conidiogenous cells blastic, integrated, determinate, denticulate. Conidia solitary, acrogenous, dry, hyaline, helicoid, consisting of a filament tightly coiled 3-6 times (mostly 4-5 times) in three planes forming a globose to subglobose conidium 15-17 x 16-20 µm in size; conidial filament hyaline, septate (4-6 septa per coil), not constricted at septa.

Specimens examined: IMI 370113 (holotype), FMR 5492 (isotype), on submerged rotten *Pinus sp.* twigs. River Aiguamoix, Valle de Aran, Catalunya, S.K.

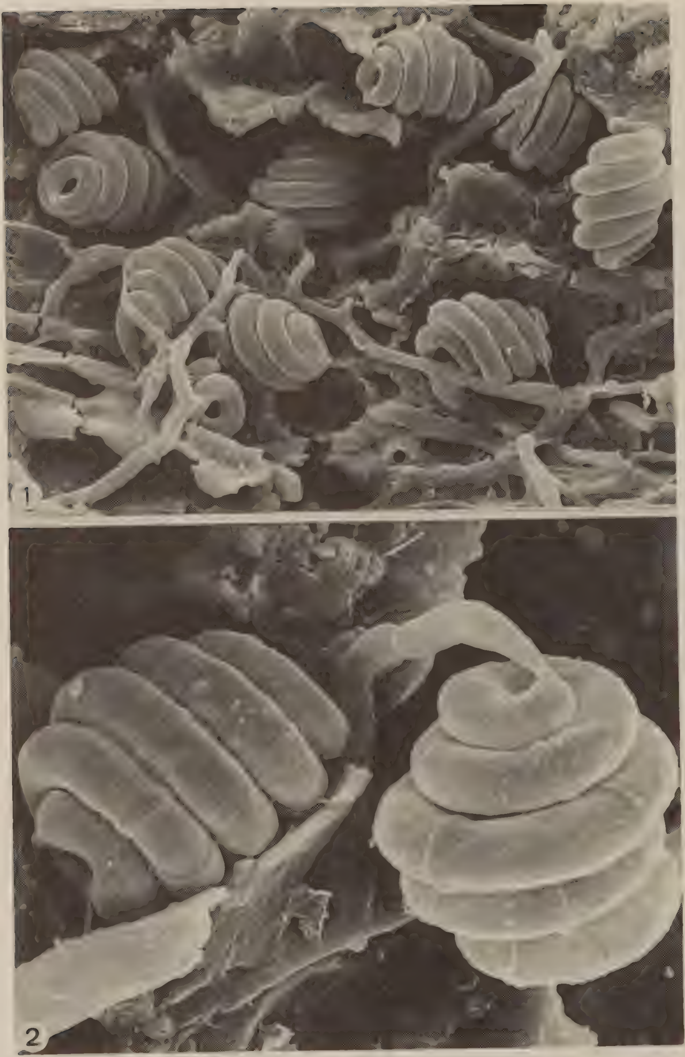
Abdullah, Spain, 11 November, 1995; FMR 5493 on submerged rotten *Pinus sp.* twigs, Alt Empordà, Cantallops, Catalunya, Spain, S.K. Abdullah, 7 November, 1995.

Morgan (1892) erected *Helicoon* based on *H. sessile* as the type. The genus is characterized by forming non-proliferating, barrel-shaped conidia from a filament coiled in three dimensions. Species belonging to *Helicoon* are commonly reported from aquatic habitats or in very shady places colonizing a variety of decaying plant materials (Abdullah & Webster, 1980; Linder, 1929; Eaton & Jones, 1971; Shearer, 1972 and Webster & Descals, 1981). Apart from their usual natural habitat, Abdullah and Webster (1980b) recorded *H. chlamydosporum* Abdullah & Webster and *H. fuscosporum* Linder from wet soil at a coniferous plantation near a water reservoir in Devon, Great Britain. Goos et al. (1986), in a review of *Helicoon*, accepted 8 species. Matsushima (1993) described *H. peruamazonense* on rotten petiole of Palmae from the Amazon River and its tributaries in Peru. More recently, Van der Aa & Samson (1994) described *H. macrosporum* on decaying bark of deciduous tree in a mixed forest in Denmark.

H. microsporum is similar to *H. farinosum* Linder and *H. sessile* Morgan in having white conidia, but in the former they are smaller. The conidia of *H. farinosum* and of *H. sessile* measure 20-27 x 22-37 µm and 20-30 x 33-59 µm respectively. Another difference from *Helicoon* species forming white conidia is the number of coils per conidium. Conidia of the present species have a maximum number of 6 coils (mostly 4-5) while the conidia of *H. sessile* have 5-16 coils and 5-8 coils in conidia of *H. farinosum*. *H. chlamydosporum* has globose to subglobose conidia (15-18 x 14-17 µm) with 4-5 coils, but can be easily distinguished from the present species by the fuscous color of its conidia and by the formation of a large number of chlamydospores in groups forming dark fuscous to black sclerotium-like bodies. Conidia of the new species could be easily confused with conidia of *Helicodendron japonicum* Abdullah (1987). The latter species produces globose to subglobose, white conidia (18.5-26.5 x 18-22 µm) with 5-8 coils, but can be easily distinguished by the fact that conidia of *H. japonicum* proliferate to form crowded chains and clusters of white conidia.

Helicoon fuscosporum Linder, Ann. Mo. Bot. Gdn. 16: 326 (1929) (Fig. 3)

Colonies on decaying leaves of deciduous trees composed of dark brown, septate hyphae, 2.5-3 µm thick and numerous erect conidiophores. Colonies up to 1.5 cm in diam on 0.1% malt extract agar (MEA) in 2 weeks at 15°C, reverse fuscous black. Aerial mycelium cottony, loose, dark brown, composed of branched septate light brown hyphae 2.5-3 µm wide. Submerged mycelium septate, dark brown 2-2.5 µm wide. Conidiophores erect, macronematous, mononematous, thick walled, fuscous below, dilute fuscous above, arising from the submerged mycelium, simple



Figs. 1-2. *Helicoon microsporum* (FMR 5492). 1, x1100; 2, x3200

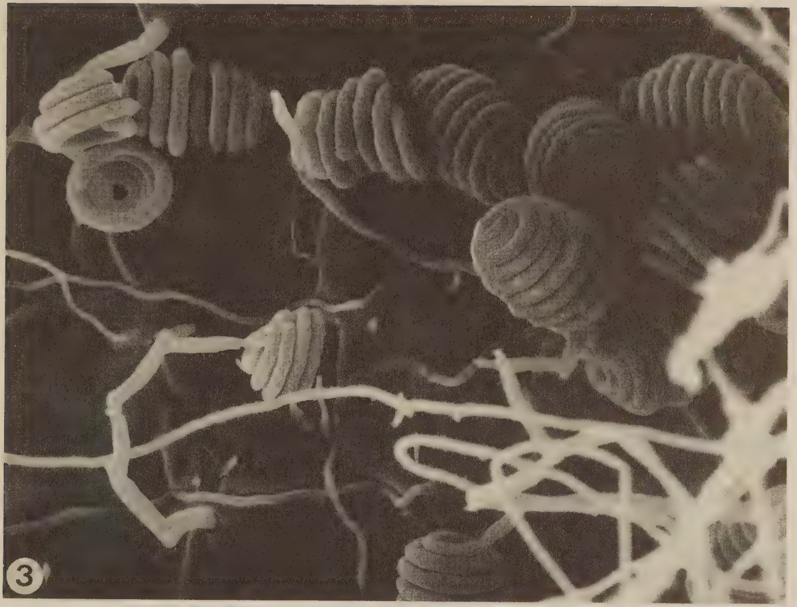


Fig. 3. *Helicoon fuscosporum* (FMR 5494). x950.

or branched up to 150 µm in length and 4-5 µm wide, mostly bearing more than one conidium. Conidia solitary, dry, acropleurogenous, fuscous; conidial filament 3.5-4.5 µm, coiled 6-13 times in three planes to form ellipsoidal to oval conidia 17-22 x 25-50 µm size.

Specimens examined: FMR 5494, on submerged decaying oak leaves, Alt Emporda, Cantallops, N. Catalunya, Spain, S.K. Abdullah, 7 November, 1995; FMR 5495, on submerged decaying *Salix* leaves, Arriu de Bordius, N. Catalunya, Spain, S.K. Abdullah, 12 November, 1995; FMR 5496, on submerged decaying *Quercus* leaves, Rio Arria dera, Soberpera, N. Catalunya, Spain, S.K. Abdullah, 12 November, 1995.

This is a very common species in the United States and Europe (Linder, 1929; Beverwijk, 1953; Abdullah & Webster 1980 a,b). It has also been reported from Japan by Matsushima (1975). The species was detected several times from a variety of submerged decaying leaves during this study. The present finding represents the first report for the species in Spain. We have obtained several isolates in pure culture. Most isolates sporulate very well in plates containing 0.2% malt extract agar incubated at 15°C under light. One isolate (FMR 5494) was found to produce abundant chlamydospores in culture. In a previous study, Abdullah and Webster (1980) reported the production of chlamydospores in pure cultures by *H. chlamydosporum* and *H. fuscosporum*.

ACKNOWLEDGMENTS

The authors are indebted to Prof. J. Webster for kindly reviewing the manuscript, and Dr. J.M. Escolà for correcting the latin diagnosis. This work was supported by the Fundació Ciència i Salut.

REFERENCES

Aa, H.A. van der and Samson, R.A. (1994). A new species of *Helicoon*. Mycological Research, **98**: 74-76.

Abdullah, S.K. (1987). Two new species of *Helicodendron*. Nova Hedwigia, **44**: 339-343.

Abdullah, S.K. and Webster, J. (1980a). Aquatic and aero-aquatic hyphomycetes from Ireland. Irish Naturalist Journal, **20**: 49-55.

Abdullah, S.K. and Webster, J. (1980b). Occurrence of aero-aquatic fungi in soil. Transactions of the British Mycological Society, **75**: 511-514.

Beverwijk, A.L. Van (1953). Helicosporous hyphomycetes I. Transactions of the British Mycological Society, **36**: 111-124.

Eaton, R.A. and Jones, E.B. G. (1971). The biodeterioration of timber in water cooling towers. II. Fungi growing on wood in different positions in a water cooling system. Material und Organismen, **6**: 81-92.

Goos, R.D., Abdullah, S.K., Fisher, P.J. and Webster, J. (1986). The anamorph genus *Helicoon*. Transactions of the British Mycological Society, **87**: 115-122.

Linder, D.H. (1929). A monograph of the Helicosporous Fungi Imperfecti. Annals of the Missouri Botanical Garden, **16**: 227-388.

Matsushima, T. (1975). Icones Microfungorum a Matsushima Lectorum. pp. 209 Pl. 1-405 published by the author, Kobe, Japan.

Matsushima, T. (1993). Matsushima Mycological Memoirs No. **7**. pp. 75 Pl. 1-131 published by the author, Kobe, Japan.

Morgan, A.P. (1892). North American Helicosporae. Cincinnati Society of Natural History Journal, **15**: 39-52.

Shearer, C. (1972). Fungi of the Chesapeake Bay and its tributaries III. The distribution of wood-inhabiting Ascomycetes and Fungi Imperfecti of the Patuxent River. American Journal of Botany, **59**: 961-969.

Webster, J. and Descals, E. (1981). Morphology distribution and ecology of conidial fungi in freshwater habitats. In Biology of Conidial Fungi I. (ed. G. T. Cole and B. Kendrick) pp. 295-355. New York and London, Academic Press.

MYCOTAXON

Volume LX, pp. 455-469 October-December 1996

HYPHOMYCETES FROM STREAMS: NEW TAXA AND NEW COMBINATION

Ludmila Marvanová

Czech Collection of Microorganisms, Tvrdého 14, 602 00 Brno, Czech Republic

and

Enrique Descals

Instituto Mediterráneo de Estudios Avanzados (UIB-CSIC), c/o Dpto. Biología
Ambiental, Universitat Illes Balears, 07071 Palma de Mallorca,
Spain

Abstract: *Anguillospora fustiformis* sp. anam. nov. and *Pleuropedium multiseptatum* sp. anam. nov. are described. *Tricladium minutum* comb. nov. is proposed for *Scorpiosporium minutum.*

Key words: new taxa, new combination, *Anguillospora, Pleuropedium, Scorpiosporium, Tricladium.*

Anguillospora fustiformis

Apothecia identified as *Hymenoscyphus imberbis* (Bull.: Fr.) Dennis by M. Svrček (Prague), were collected on angiosperm twigs partly immersed in water. Multi- and monoascosporic cultures gave rise to the hyphomycetous anamorph described below:

Anguillospora fustiformis Marvanová et Descals sp. anam. nov. Fig. 1

Etym.: *fustis* (L.) = stick

Moniliales. Coloniae atrogriseae, modice crescentes, mycelium aerium abundans, lanosum, funiculosum. Hyphae pallidae vel atrobrunneae cum parietibus crassis, nonnumquam rugosis. Primordia ascomatum ex hyphis spiraliter contortis vel irregulariter intricatis. Conidiophora singularia vel aggregata, apicalia, simplicia vel raro pauce ramosa, septata, cellulis subinflatis. Cellulae conidiogenae subclavatae, usque ad 25 x 2.5-6 µm , rarissime cum elongationibus paucis, percurrentibus vel sympodialibus, apice truncatae vel convexae. Conidia recta vel paulo curvata, obclavata, subcylindrica vel clavata, raro in parte media attenuata, (50-)80-260(-390) x 6-10(-12) µm, usque ad 25 septata, apice subulata vel obtusa, basi convexa vel obtusa, extensio basalis rara, excentrica; cellulae nonnullae conidiorum subinflatae; conidia vetusta saepe disarticulata. Dehiscentia schizolytica.

Habitat: Ex apotheciis ad ramos emortuos prope fluminem parvum iacentes, loco Košiariská dicto, montibus Little Carpathians, prope oppidum Bratislava, Res publica Slovaca, isolata. **Holotypus: PRM 842929**, ex CCM F-17882, **isotypus PRM 842928**, ex CCM F-17882.

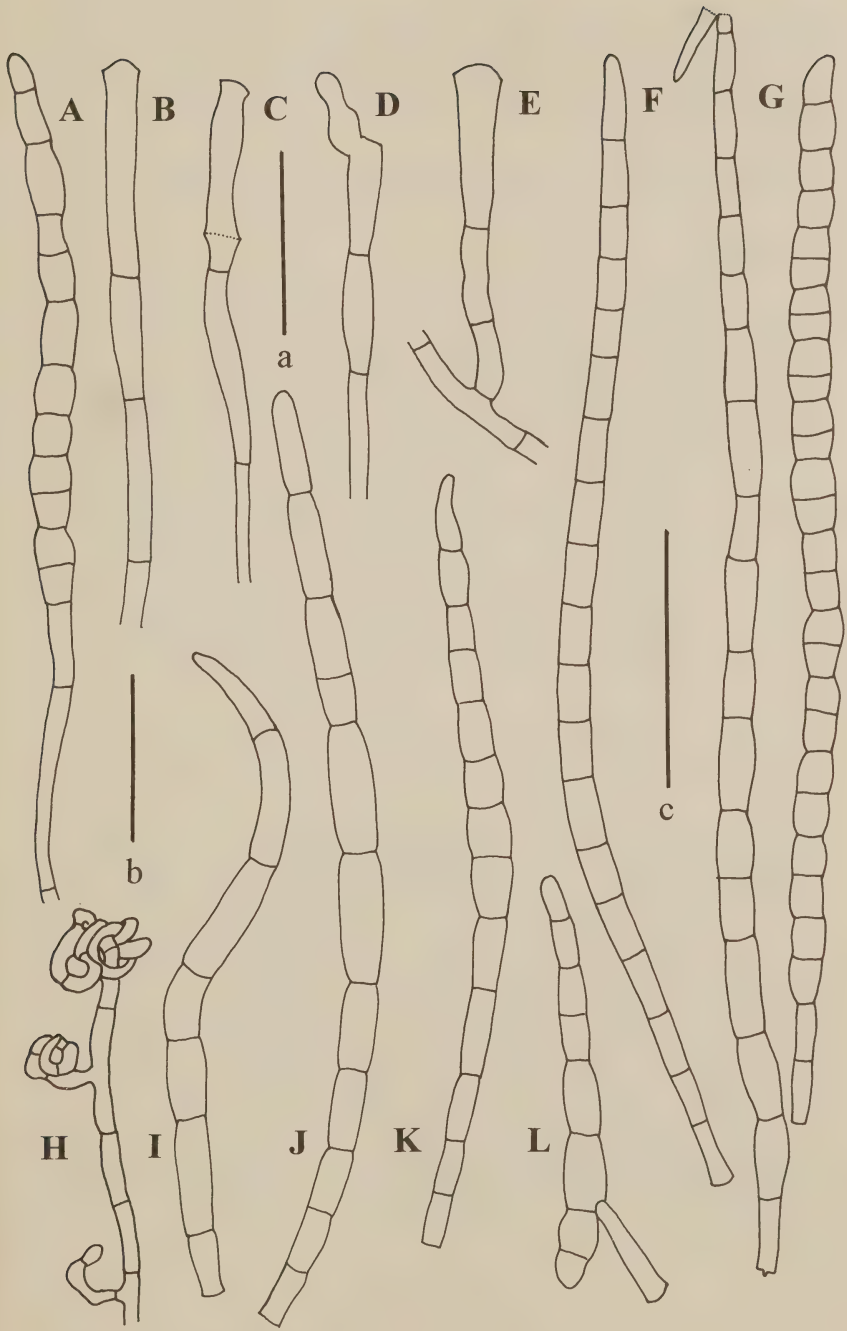
Colony (2% MA) (mono- or multiascosporic) dark grey, growing moderately fast, reverse black. Aerial mycelium abundant, hairy, funiculose; hyphae either pale and thin-walled or dark brown and thick-walled, sometimes roughened. Ascomatal initials frequent in some isolates, terminal or lateral on the pale hyphae, consisting of coiled to variously entangled hyphal ends. Ripe ascomata not seen. Conidial sporulation aerial or aquatic and then above, at or below the water level. Conidiophores single or aggregated, apical or lateral, simple or rarely with one branch, septate, cells sometimes slightly inflated. Conidiogenous cells subclavate, up to 25 x 2.5-6 µm, occasionally with a percurrent or sympodial elongation, scar flat or convex, often with a nipple in the centre. Conidia straight to slightly curved, obclavate to nearly cylindrical to clavate, rarely attenuate near the middle, (50-)80-260(-390) x 6-10 (–12) µm, multiseptate, apex subulate to rounded, base slightly convex or rounded, sometimes with a central nipple, basal extension rare, excentric; some conidial cells often variously inflated; conidial outline irregular or wavy due to cell inflations. Secession schizolytic. In older cultures conidia often disarticulate into units of one to several cells. Germination from any cell; microcycle conidiation rare, spent secondary conidiophores simulating conidial branches (fig. 1 L).

Isolates examined: CCM F-17882, CCM F-14984, CCM F-15084, CCM F-15184, CCM F-15284, CCM F-16084, CCM F-16184, CCM F-16284, CCM F-16484, CCM F-16584, CCM F-16684, CCM F-16784, all isolated from ascospores shot onto agar; apothecia (*Hymenoscyphus imberbis*) collected on twigs near or in a stream in the Little Carpathian Mountains, Slovakia, in Nov. 1982 and 1984 by L. Marvanová. B247-A-1, apothecia on a twig near water, Welshbury Wood, Forest of Dean, UK (OS 683157), May 1981, E.Descals. Single-ascospore isolate.

A.. fustiformis differs from the broad-spored species of *Anguillospora* Ingold (1942) by the typically straight, stout conidia with irregularly inflated cells and by the absence of the percurrent basal extension. The irregular conidial outline is characteristic also of the simple conidia of *Pachycladina mutabilis* Marvanová (1988), which are often straight and considerably overlap with those of *A. fustiformis*. However, the former have a typically inflated basal extension or a bulbous base and give rise to whitish colonies on 2 % MA. There is also a significant overlap with conidia of the *Anguillospora*-like anamorph of *Hymenoscyphus malawiensis* Fisher et Spooner (1987),

---

Fig. 1. *Anguillospora fustiformis*, pure culture. A: developing conidium. B-E: conidiophores. H: ascomatal initials. F,G,I-L: conidia. L: secondary conidium formation (primary conidium with spent conidiogenous cell). All drawings from CCM F-17882 except H: from CCM F-15284. B-E: scale bar a = 20 µm; H: scale bar b = 20 µm; the rest: scale bar c = 50 µm.


A
B
C
D
E
F
G
a
b
c
H
I
J
K
L

where the conidial dimensions are 80-130 x 6-10 µm (however, acording to figs. 20-21 the conidial width may reach 14 µm), the conidial cells are somewhat inflated and the colonies are dark grey like in *A. fustiformis*. Both anamorphs may be differentiated on the basis of the more regular outline and nearly twice smaller length/width ratio of the conidia of *H. malawiensis*.

The Descals' isolate was derived from sole-shaped, c. 13 µm long ascospores from a disc-like, cream-coloured apothecium with 8-spored asci measuring c. 100 x 10 µm .

Pleuropedium

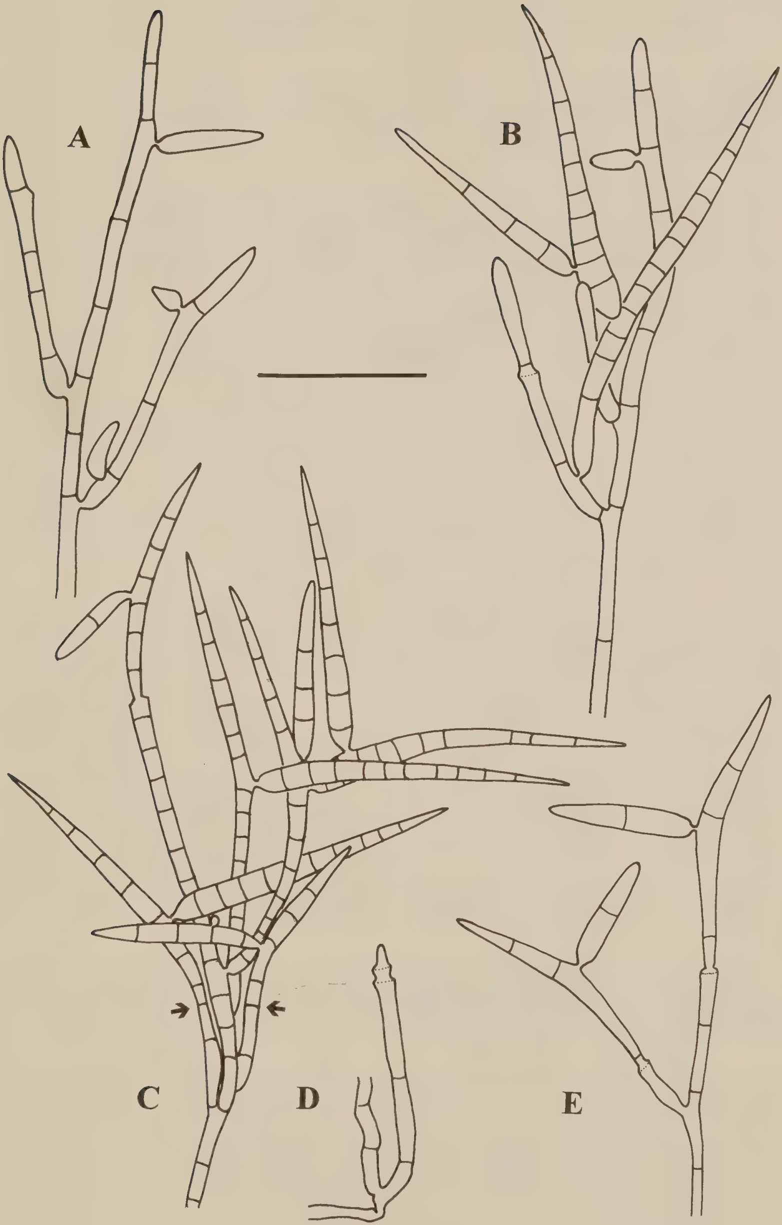
The anamorph genus *Pleuropedium* Marvanová et Iqbal (1973) was described as monotypic. Its type species, *P. tricladioides* Marvanová et Iqbal was based on CCM F-311, which was isolated from the Slovak Republic. However, the protologue also included characters from HME (=EXR) 2963 from the U.K. Differences in their conidial size and shape were mentioned, but considered to represent intraspecific variation. The first author, who prepared the description, had no living material of HME 2963 at her disposal and presumed that the conidial ontogeny and colony characters were identical with those of CCM F-311. Further studies of more specimens in pure culture revealed two groups of isolates, distinctly different in conidiogenesis as well as in colony characters. These differences seem significant and stable enough to justify recognition of a second species, which is here segregated from *P. tricladioides* on the basis of its multiseptate conidia with typically acute ends, borne on monoblastic (annellidic) conidiogenous cells and a green pigment usually produced on 2% MA especially when submerged and/or exposed to daylight. Because the material in HME 2963 is scanty and poorly preserved, another, more recent British isolate has been chosen as the type.

Pleuropedium multiseptatum Marvanová et Descals sp. anam. nov. Figs. 2-4, 7 A,B

Etym.: *multiseptatus* (L.)- referring to the densely septate conidial elements.

Moniliales. Coloniae in cultura artificiali pallidae vel pallide griseae, modice crescentes, mycelium aerium saepe lanosum, funiculosum, mycelium in agaro nonnumquam cum cellulis inflatis aggregatis. Conidiophora singularia, praecipue apicalia, usque ad 250 x 4-5 µm, in parte distali saepe ramificata. Cellulae conidiogenae monoblasticae, apicales, raro laterales, apice truncatae, determinatae vel cum elongationibus percurrentibus paucis. Conidia singularia, apicalia, elementa cum apicibus acutis vel acuminatis, densiter septata; axis rectus, arcuatus vel flexus ad insertionem rami, 38-75 (-100) x 3.5-6.5 µm, typice 6-12 septatus, cum extensione basali percurrente, aciculari, 2.5-12.5 (–22.5) µm longo; rami recti vel paulo arcuati, obclavati, cum insertione valde constricta; ramus primarius (28-)35-65(-98) x 4-7 µm, (3)5-10 septatus, saepe ad cellulam secundam usque ad quintam axis insertus, nonnumquam flexus apud insertionem rami secundarii;

Fig. 2. *Pleuropedium multiseptatum,* type. A-C, E: developing conidia (arrows: probable point of conidial secession; highlighting the monoblastic nature of the conidiogenous cells). D: spent conidiophore with a percurrent conidiogenous cell. Scale bar = 25 µm.


A
B
C
D
E

ramus primarius distalis rarus, brevior; ramus secundarius 22-55(-75) x (2.5-)4-6.5 µm, 3-9 septatus; ramus tertiarius rarus, 22-40 x 4-5.5 µm. Dehiscentia schizolytica.

Habitat: *Juncus effusus*, in flumine Dart, Bellever Bridge, Dartmoor National Park, Devon, U.K., Mar. 1975, E. Descals et J. Webster. **Holotypus IMI 369970, isotypi: IMI 369971** et Herb. E. Descals A 318-1-7.

Colony (2 % MA) pale beige or pale grey, growing moderately fast, aerial mycelium mostly woolly, funiculose; substrate mycelium in some isolates with aggregates of thin-walled inflated cells; a green extracellular pigment appearing typically in agar after submergence and/or exposure to daylight. Sporulation underwater. Conidiophores single, mostly apical, up to 250 x 4-5 µm, branches acrotonous. Conidiogenous cells monoblastic, apical or rarely lateral, determinate or with a few percurrent elongations, scars flat. Conidia single, apical, elements with acute or acuminate ends, closely septate; axis straight, arcuate or bent at branch insertion, 38-75(-100) x 3.5-6.5 µm, typically 6-12 septate, basal extension typically acicular, percurrent, rarely excentric, 2.5-12.5(-22.5) µm long; branches straight or slightly curved, obclavate, primary branch (28-)35-65(-98) x 4-7 µm, (3) 5-10 septate, inserted on the second to fifth cell of the axis, sometimes bent at the secondary branch insertion; distal primary branch occasional, shorter than the proximal one; secondary branch (in some isolates often orientated upwards) 22-55(-75) x (2.5-)4-6.5 µm, 3-9 septate; tertiary branch rare, (in one isolate relatively frequent), 22-40 x 4-5.5 µm. Secession schizolytic.

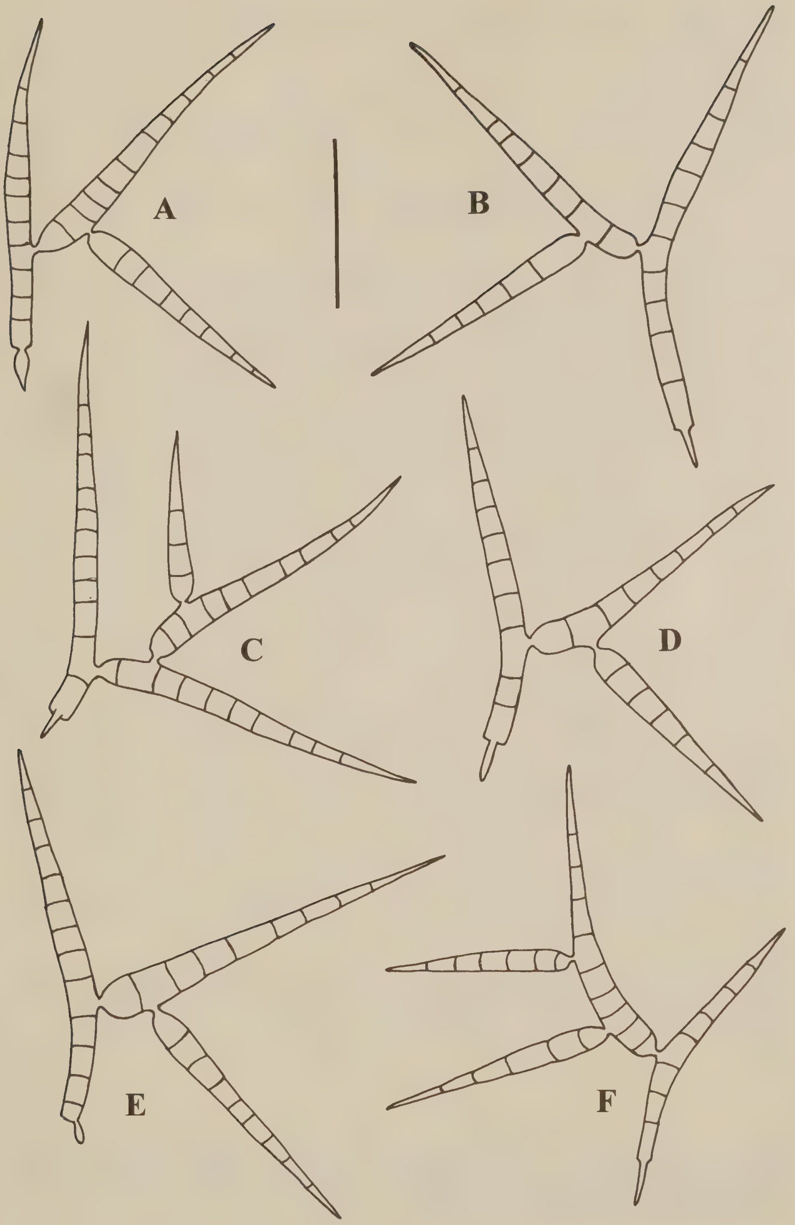
Other isolates examined: CCM F-46594, from foam from Cheticamp River, c. 10 km upstream from the mouth of Robert Brook, Cape Breton National Park, Nova Scotia, Canada, Oct. 1994, L. Marvanová. CCM F-14284, from foam from stream nr. Rejvíz, the Hrubý Jeseník Mountains, Czech Republic, May 1984, L. Marvanová. CCM F-15086, from *Juncus conglomeratus* decaying stems in a draining canal, nr. the village Mútna, Bystranská dolina valley, Slovenské Beskydy Mountains, Slovak Republic, May 1986, L. Marvanová. CCM F-13289, from foam from the right tributary of the river Svratka, near the village Kadov, Czech-Moravian Uplands, Czech Republic, May 1989, L. Marvanová. A319-1-1, from foam from stream flowing through pastures, on road from Pentrefoelas to Nebo, Snowdonia National Park, N. Wales, U.K., Mar. 1975, E. Descals. B137-1-12, from foam from stream flowing through *Betula* and conifer woodland, nr. Loch Dubh (Strath Rusdale), Scottish Highlands, U.K., Nov. 1979, E. Descals.

Conidia of *P. multiseptatum* may resemble aberrant conidia of *Tricladium attenuatum* Iqbal, which, however, have thinner elements, the axis being straight or slightly curved and attenuate near the branch insertions.

This species seems to be more frequent than *P. tricladioides*. Records documented by illustrations or collections seen by us are from: Chile (Burgos & Shearer 1987, fig. 1: 5), Czech Republic (Kotlaba 1983, det. L. Marvanová), Greenland (Engblom *et al.* 1986), N. Zealand (Aimer & Segedin 1985, fig. 3 v), Norway (Brăthen 1984, fig. 2 L),

---

Fig 3. *Pleuropedium multiseptatum*, type. Conidia. A and B are regarded as typical. Scale bar = 25µm.


A
B
C
D
E
F

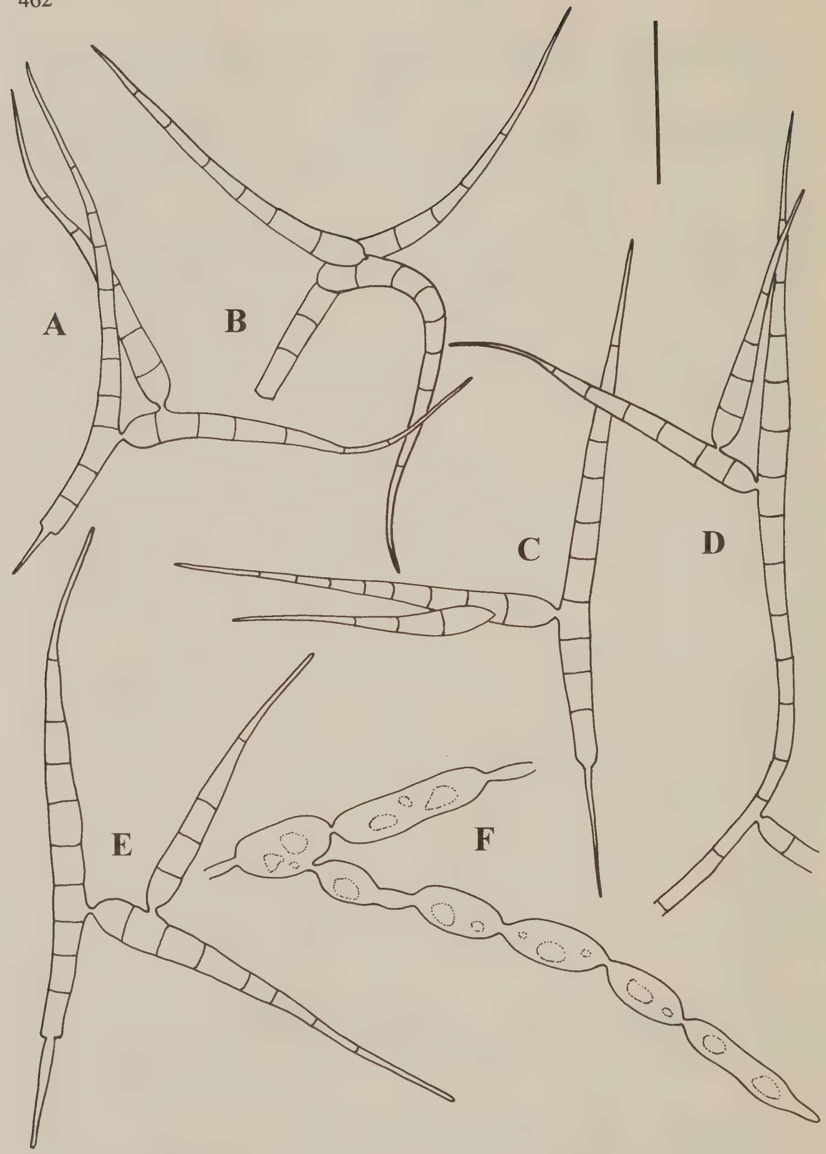


Fig. 4. *Pleuropedium multiseptatum*. A-C, E, conidia. D, developing conidium. F, inflated cells. (A,B: HME 2963; C,D,F: CCM F-14284, E: CCM F-46594). Scale bar = 20 µm.

Sweden (Marvanová & Müller-Haeckel 1981), U.K. (Ingold 1965, figs. 1 A: 3,10,12, as *?Ingoldia sp.*, Ingold 1974, fig. 4: 3, as *Gyoerffyella sp.*, Marvanová & Iqbal 1973, figs. 1-4).

Because the name *Pleuropedium tricladioides* is now used in a narrower sense, the diagnosis is amended as follows:

Pleuropedium tricladioides Marvanová et Iqbal (1973), emend. Marvanová
Figs 5,6,7 C,D

Colony (2 % MA) light buff, slow growing, reaching c. 10 mm diam. after 7 days at 20-22° C, compact, glabrous, aerial mycelium in the middle, yellowish ochraceous, reverse with a diffusible reddish brown pigment. Substrate mycelium with thin-walled, inflated cells. Sporulation underwater, with or without aeration. Conidiophores mostly lateral, simple or branched, up to 60 x 2-3 μm. Conidiogenous cells discrete or integrated, single or grouped, polyblastic, mostly concurrent with conidia, 10-13 x 2.5-3.5 μm, often denticulate. Conidia in fascicles, closely sequential, elements obclavate, with subacute ends, up to 5 septate; axis straight to slightly sinuous, 26-51 x 3-5 μm, 3-4(5) septate, base flat or papillate or with a short, conoid extension; primary branch mostly on the second cell of the axis, 30-42 x 3-5.5 μm, 1-4 septate, distal primary branch occasional; secondary branch often orientated downwards, 20-35 x 2.5-3.5 μm, 0-3 septate; tertiary branch rare. Secession schizolytic.

Isolates examined: CCM F-11087 from foam from Allen Creek, nr. Sackville, New Brunswick, Canada, Apr. 1987, L. Marvanová. CCM F-311 (ex type) , from foam in a mountain rivulet nr. the chalet Kamzík, Starý Smokovec, Vysoké Tatry Mountains, Slovak Republic, Aug. 1968, L. Marvanová. CCM F-11777, from foam in a stream nr. the village Bělá -Domášov, Hrubý Jeseník Mountains, Czech Republic, Dec. 1977, L. Marvanová. CCM F-10783, from foam from River Teign, Glassy Steps, Dartmoor National Park, Devon, U.K., Feb. 1983, L. Marvanová. A311-1-3, from foam from stream flowing through acid moorland, River Dart at Bellever Bridge, Dartmoor National Park, Devon, U.K., Mar. 1975, E. Descals.

Conidia of *P. tricladioides* are somewhat similar to the lesser branched conidia with tapering elements seen in some isolates of *Varicosporium elodeae* Kegel.

Owing to the hitherto broader concept of *P. tricladioides*, records without illustrations or voucher specimens are unreliable. If only those accompanied by drawings are to be considered in addition to our own, the species seems to be rare: Slovak Republic (Marvanová & Iqbal 1973), U.K. (Ingold 1979 fig. 48).

Scorpiosporium

Iqbal (1974) distinguished his genus *Scorpiosporium* from *Tricladium* Ingold by the "scorpioid" conidial axis (bent at branch insertions), the broad insertion of laterals and occasional secondary branching of conidial arms before detachment. However, we see a continuum between *S. minutum* and *Tricladium* species and believe it is premature for generic distinction. A microconidial synanamorph was found by E. Descals in one of his isolates.

Tricladium minutum (Iqbal) Marvanová et Descals comb. nov. Fig. 8

Basionym: *Scorpiosporium minutum* Iqbal (1974) Biologia (Lahore) 20:17.

Redescription of the species based on British isolates:

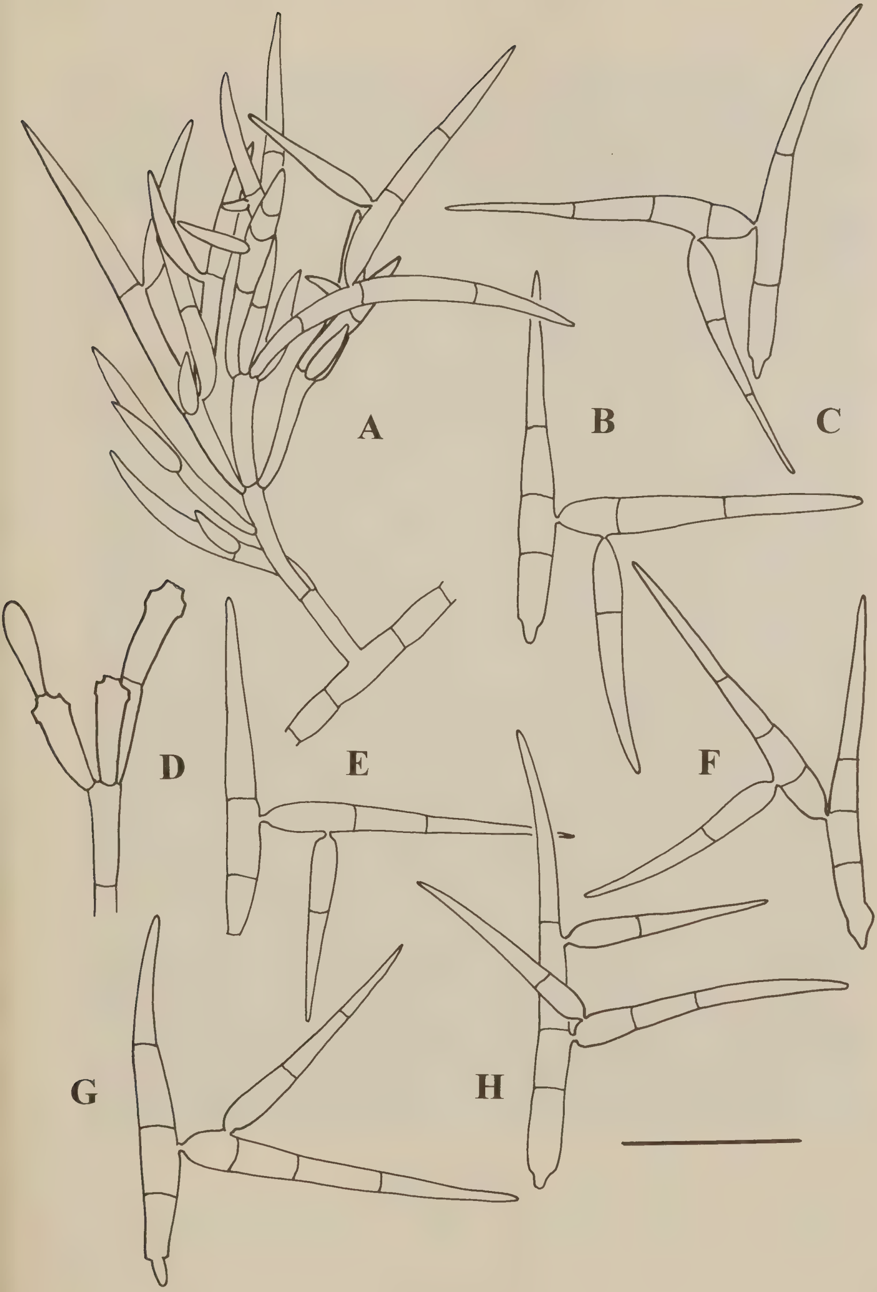
Colony (2% MA) pale brown to dark ochraceous, growing slowly, aerial mycelium abundant, substrate mycelium with groups of isodiametric inflated cells with brownish walls. Sporulation underwater. Conidiophores semimacronematous, single, simple, up to 110 x 2.5-3 µm. Conidiogenous cells integrated, monoblastic, single, apical, typically percurrent, annellations few. Conidia single, apical, septate, ends subulate to acute, axis usually bent at branch insertions, often twisted between branches, rarely substraight, slightly tapered towards both ends, 47-105(-120) x 2.5-4 µm, sometimes widened below branches; base truncate or with a subulate percurrent basal extension up to 20 µm long; branches (1)2(3), diverging in different planes, antrorse and broadly divergent to perpendicular, or the distal retrorse, 5-10(-15) µm apart, insertion broad; proximal branch 22-57(-85) x 2.5-3 µm, distal branch 17-45 µm long. A small percentage of conidia may form dichotomously branching arms before secession. Secession schizolytic.

Microconidial synanamorph: spermatial, on hyphae. Conidiophores mostly lateral, single, simple, up to 50 µm long. Conidiogenous cells phialidic, single, rarely in pairs, acrogenous, lageniform, 12-15 x 2.5-3.5 µm, collarette cup-shaped, up to 4 µm long, periclinal thickening present. Conidia apical, in chains or groups, short-clavate, aseptate, 2-2.5 x 1-1.5 µm , base truncate. Germination not seen.

Isolates examined: A-311-2-21 (= **IMI 369972**), from culm of *Juncus effusus*, in stream flowing through acid moorland, River Dart, Bellewer Bridge, Dartmoor National Park, Devon, U.K., Mar. 1975, E. Descals. B109-3-5 (= **IMI 369973**), foam from river flowing through conifers and grassland, Linn of Dee, nr. Aberdeen, Scotland, Nov. 1979, E. Descals. B125-1-2 (= **IMI 369974**, with microconidial synanamorph), foam from waterfall, Silver Bridge, Scottish Highlands, Nov. 1979, E. Descals. CCM F-16887, foam from a small stream , Ogden Mill Cross, Trans Canada Highway, nr. Sackville, New Brunswick, Canada, Apr. 1987, L. Marvanová.

Along with the description of *S. minutum,* three names have been invalidly recombined (Art. 33.2) in the genus, i.e. *Scorpiosporium angulatum* (Ingold) Iqbal (1974), *S. anomalum* (Ingold) Iqbal (l.c.) and *S. gracile* (Ingold) Iqbal (l.c.).

Fig. 5. *Pleuropedium tricladioides,* type. A: developing conidia. D: spent conidiophore (note the polyblastic conidiogenous cells). The rest: conidia. Scale bar = 20 µm.


A
B
C
D
E
F
G
H

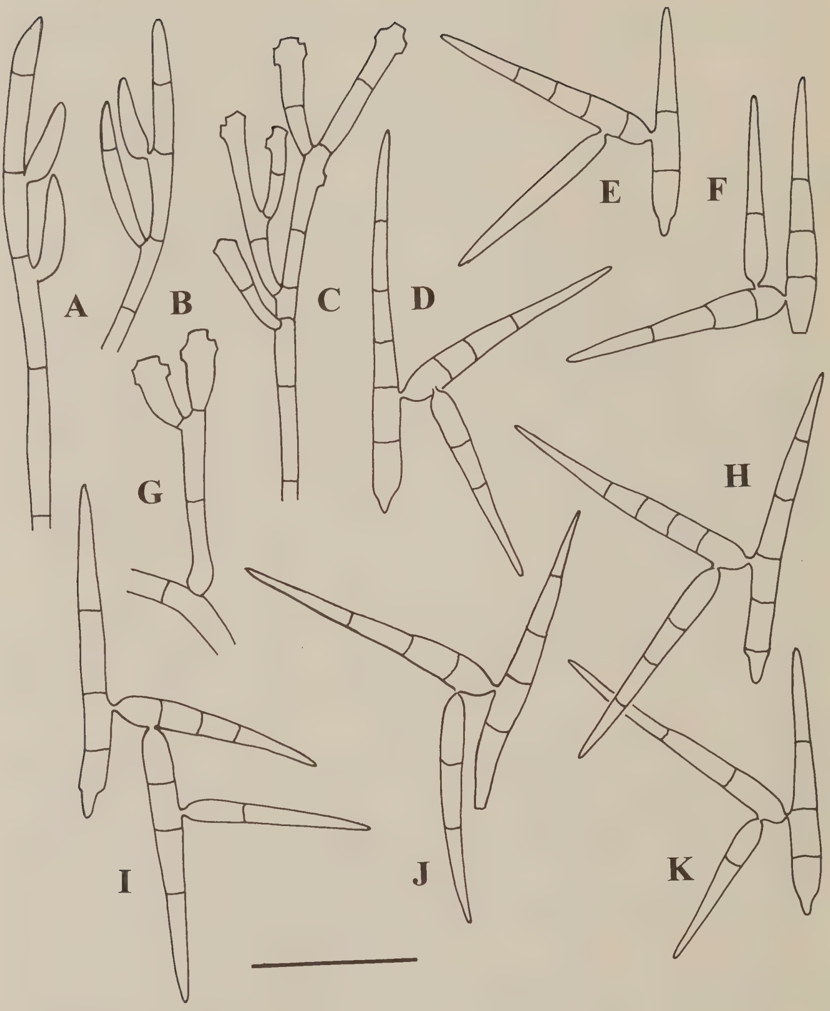


Fig. 6. *Pleuropedium tricladioides*, E. Descals A311-1-3. A,B, developing conidia. C,G, spent conidiophores. D-F, H-K, conidia. Scale bar = 20 µm.

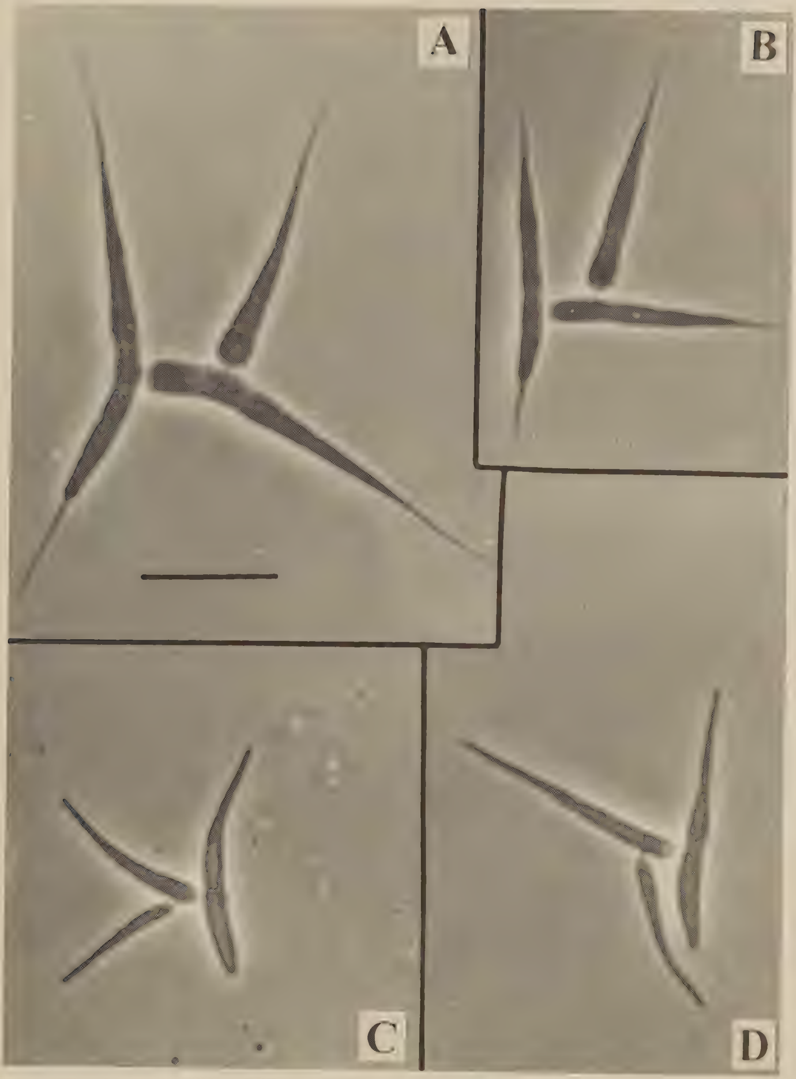


Fig. 7. A, B, *Pleuropedium multiseptatum* CCM F-15086. C, D, *Pleuropedium tricladioides*, type. Scale bar = 20 µm.

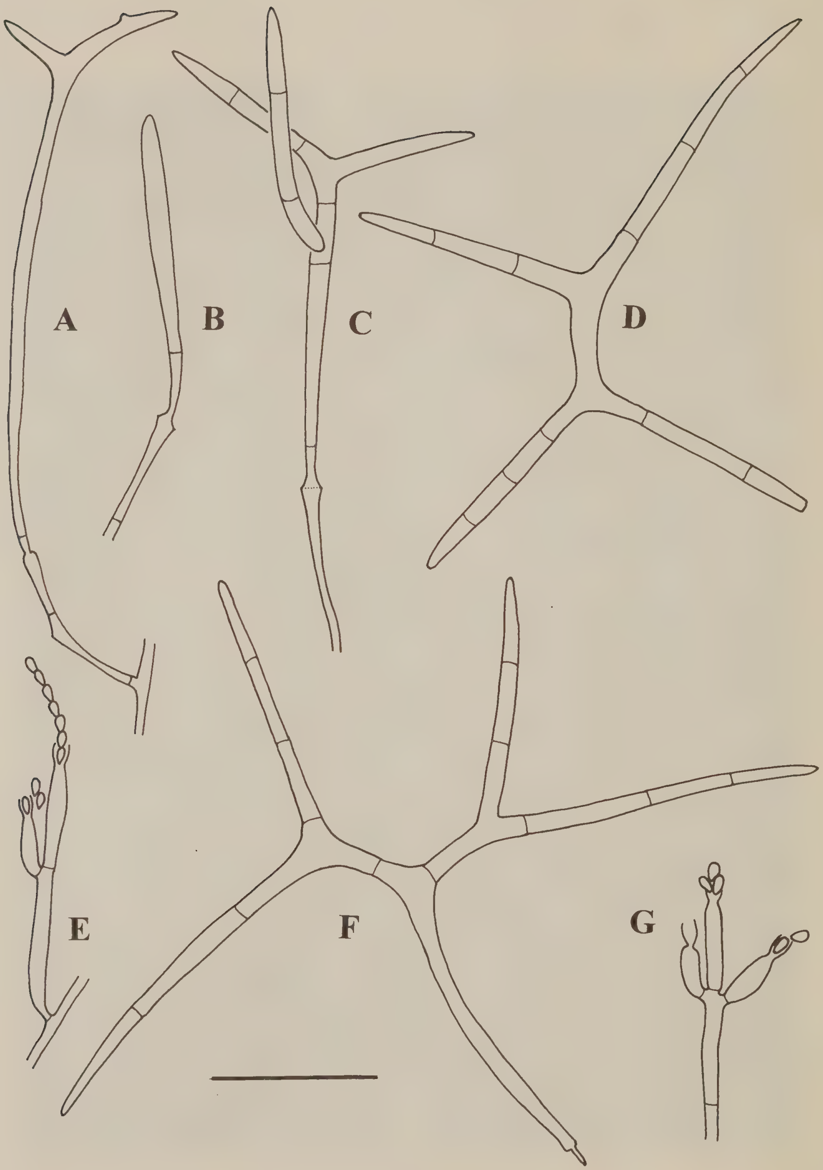


Fig. 8. *Tricladium minutum*, E. Descals B125-1-2. A-C, conidial development. D,F, conidia. E,G, microconidial synanamorph. Scale bar = 20 µm.

ACKNOWLEDGEMENTS

E. Descals´ contribution to this paper has been partly supported by the Project "Flora Micológica Ibérica", DGICYT PB92-0012. The staff at the Limnology laboratories of the Departament de Biologia Ambiental, Universitat de les Illes Balears are thanked for providing facilities. Prof. J. Webster (Exeter) kindly reviewed this paper.

REFERENCES

AIMER, R.D. & SEGEDIN, B.P. (1985). Some aquatic hyphomycetes from New Zealand streams. N.Z. J. Bot. 23: 273-299.

BRĂTHEN, I. (1984). The aquatic stauroconidial hyphomycetes of Norway with notes on the Nordic species. Nordic J. Bot. 4: 375-392.

BURGOS, J. & SHEARER, C.A. (1987). Hifomicetes acuáticos en un gradiente bioclimático en Chile. Bol. Micol. 3: 101-109.

ENGBLOM, E., LINGDELL, P.-E., MARVANOVÁ, L. & MÜLLER-HAECKEL, A. (1986): Foam spora in running waters of southern Greenland. Polar Res. 4 N.S.: 47-51.

FISHER, P. J. & SPOONER, B. (1987). Two new ascomycetes from Malawi. Trans. Br. Mycol. Soc. 88: 47-54.

INGOLD, C.T. (1942). Aquatic hyphomycetes from decaying alder leaves. Trans. Br. Mycol. Soc. 25: 339-415.

INGOLD, C.T. (1965). Hyphomycete spores from mountain torrents. Trans. Br. Mycol. Soc. 48: 453-458.

INGOLD, C.T. (1974). Foam spora from Britain. Trans. Br. Mycol. Soc. 63: 487-497.

INGOLD, C.T.(1979). Advances in the study of so-called aquatic hyphomycetes. Am. J. Bot. 66: 218-226.

IQBAL, S.H. (1974). *Scorpiosporium minutum* gen. nov. sp. nov., an aquatic hyphomycete. Biologia (Lahore) 20: 17-21.

KOTLABA, F. (1983). List of fungi found on the excursion during the VII. All-State Mycol. Conf., České Budějovice, 13-18 Sept.1982 (in Czech). Sbor. Jihočes. Muzea v Č. Budějovicích, Přírod. Vědy 23: 37-48.

MARVANOVÁ, L. (1988). New hyphomycetes from aquatic environments in Czechoslovakia. Trans. Br. Mycol. Soc. 90: 607-617.

MARVANOVÁ, L. & IQBAL, S.H. (1973). *Pleuropedium tricladioides* gen. et sp. nov. Antonie van Leeuwenhoek 39: 401-408.

MARVANOVÁ, L. & MÜLLER-HAECKEL, A. (1981). Water-borne spores in foam in a subarctic stream system in Sweden. Sydowia 33: 210-220.

MYCOTAXON

Volume LX, pp. 471-480 October-December 1996

ALLRUS: a system for standard description, identification and classification of *Russulaceae*

V. Robert* and B. Buyck**

* Mycothèque de l'Université Catholique de Louvain, 3 Place Croix du Sud, B-1348
Louvain-la-Neuve, Belgium.

** Muséum National d'Histoire Naturelle, Laboratoire de Cryptogamie, 12 Rue
Buffon, F-75010 Paris, France

Abstract

An original software package, called ALLRUS, has been developed to provide an easier, automatic and objective means to identify, classify and describe members of the *Russulaceae*.

The main features of the software, the selection and coding of characters, and some of the problems encountered in the construction of the reference files are discussed.

Introduction

Russula is the largest and most complex genus in *Russulaceae* (Basidiomycotina). The initiative for ALLRUS was taken in 1993 when both authors agreed to collaborate for the computer-assisted identification of species of *Russula* and to provide a means to identify, classify and describe *Russulaceae* from around the world. An original software program, called ALLRUS, has been developed for this purpose. Coding of published descriptions of the members of the genus began in 1994 and the database now contains 609 descriptions for 486 species of *Russula*. In 1995, the reference data file was extended to tropical African *Lactarius* (in collaboration with A. Verbeken, Gent University) and the other genera of *Russulaceae*.

Selection of characters

The choice of the characters and character states to be considered in ALLRUS was established in five steps:

1. compile a list of all characters described for species of *Russula*,
2. select characters that have been described for an appreciable number of taxa,
3. identify the existing diversity in terminology for each selected character,
4. evaluate descriptive terms for similarity and synonymy,

5. propose a coding procedure that distinguishes the range of diversity of terminology with a minimum loss of information.

Apart from the character-set, each description was also given its own "personal form" that includes the names of genus and species, literature source, synonymy, other literature references, the date of last revision.

Characters used in the compilation of the reference data file (steps 1 and 2) were obtained from the description of species of *Russula* given in Adhikari (1988, 1990), Bills (1984, 1985, 1986, 1989), Bills and Miller (1984), Blum (1962), Burlingham (1913), Buyck (1988, 1990, 1993, 1994, 1995), Chiu (1945), Einhellinger (1985), Härkönen et al. (1993), Heim (1938) Hesler (1960, 1961), Homola and Shaffer (1975), Hongo (1955, 1968), Kauffman (1908), Kühner (1975), Marchand (1977), Murrill (1916), Romagnesi (1967), Sarnari (1984, 1991, 1992, 1993), Schaeffer (1952), Shaffer (1962, 1964, 1970a, 1970b, 1972, 1975, 1989, 1990), Singer (1938, 1939, 1950, 1957), Singer et al. (1983), Thiers (1994).

Information offered in descriptions has often been reduced by the creation of categories or attributes (step 3 and 4). The number of character states or categories depends on the nature of the character concerned. Simply choosing between presence or absence of a certain character is often inadequate or impossible. On the other hand, it is not realistic to include all existing and often ambiguous or confusing descriptive terms. For example, in the encoded English descriptions of *Russula*, the edge of the lamellae is described by the following qualifying terms: entire, smooth, even, laciniate, sinuate, fimbriate, undate, undulate, eroded, appendiculate, blunt, dentate, denticulate, crenate, crenulate, serrate, serrulate, lacerate, erose, floccose, flocculose, fuscidulous, punctate, flattened, depressed, subcanaliculate, canaliculate, etc. In addition several quantifying attributes were used to modulate these terms: strongly, slightly, poorly, heavily, largely, smoothly, minutely, entirely, scarcely, rarely, often, usually, mainly, very, etc. The complexity is even greater if one compares these terms with a parallel terminology in descriptions written in French, German or Italian.

It is clear that not only the selection of described characters, but also their expression or format (similar technique, similar circumstances, similar terminology, etc.) is essential in establishing complete comparability between descriptions of characters and thus in making them more accessible for computerization. Information should be presented in a standardized format and in an unambiguous or objective - if possible quantitative - way (how many is "numerous" ?). Absence of a generally accepted terminology and methodology make it often very difficult to understand exactly what is meant in a description and reduce comparability to a great extent. One generally has to be acquainted with the adopted terminology and description habits of all concerned taxonomists (if these are explained at all). This clearly shows the need for a standardized international descriptive terminology.

Finally, different types of algorithms were developed to code for different types of characters (step 5) in a way that allowed for the maximum number and degree of variation of intermediary states without imposing severe restrictions on the information contained in the reference files (i.e. all measurements in a description are encoded as such and not reduced to series of categories).

Complex features were described using several sub-characters, e.g. :

- the structure of the pileipellis (4 sub-characters : degree of gelification, presence of thick-walled elements, presence of inflated cells, orientation of extremities),

- the type of vegetation (4 sub-characters : principal biological form, density of vegetation, tree-type, degree of humidity),
- the ornamentation of basidiospores (7 sub-characters : amyloidity of plage, localisation of amyloidity on plage, shape of spore ornaments, form at base of ornaments, height of connections between ornaments, degree of reticulation, height of spore ornamentation).The precision of coding of complex features was tested by comparing computer-generated reconstructions derived from encoded values with illustrations of the same features provided with the original descriptions (Fig. 1).

A selection of similarity coefficients for the identification process are preferred because probabilistic identification or dichotomous keys may have misleading consequences when a limited number of characteristics are considered for identification (Robert et al., 1994; Pankhurst, 1975a). New and more flexible algorithms to compute similarity coefficients were developed (Robert and Le Boulengé, 1996). to minimize the lack of coherent information on species and the existence of uncertain or missing data (Robert and Buyck, 1994; Pankhurst, 1975b).

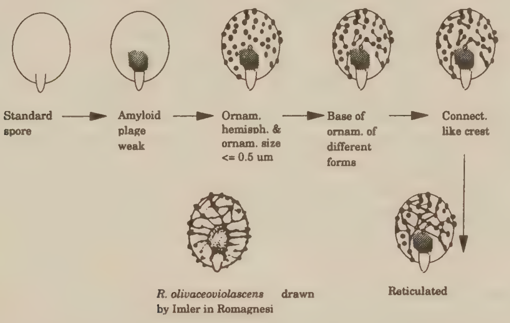

Standard spore
Amyloid plage weak
Ornam. hemisph. & ornam. size <= 0.5 um
Base of ornam. of different forms
Connect. like crest
R. olivaceoviolascens drawn by Imler in Romagnesi
Reticulated

Fig. 1. Comparison between the reconstruction by ALLRUS (using coded information based on the description of Romagnesi (1967)) of a basidiospore of *R. olivaceoviolacens* Gillet, and the drawing of Imler in the same publication.

S-comparisons (for size) were designed for quantitative continuous variables. Minimum, low mean, high mean and maximum values between 0 and 999.99 can be computed. Values provided in descriptions were encoded directly and can be compared in several ways using up to 10 different algorithms.

S-characters were used for 4 macroscopic features (pileus diameter, stipe length and width, hymenophore width, thickness of pileus context), 29 microscopical measures (length and width of spores, basidia, sterigmata, macropleurocystidia, marginal cells, extremities of pilei- and stipiti-pellis, pileo- and caulo-cystidia; length-width ratio for spores; width of pseudocystidia, hyphae of subpellis of pileus and primordial hyphae; thickness of supra- and sub-pellis in pilei- and stipiti-pellis) and two measures indicating latitude and altitude.

T-comparisons (for triangle) were designed for some discrete ordered or unordered multistate variables. Codes between 0 and 7 were used with codes 1, 3, 5 and 7 for intermediate or multistate choices and codes 0,2,4 and 6 for different character state selection.

T-characters were employed for 33 macroscopic features (type of basidiome; surface, dullness, viscosity, pruinosity, venation, zonation, striation, hygrophaneity and central shape of pileus; pubescence and shape of pileus margin; separability of pileipellis; type and attachment of hymenophore; spacing, furcation and consistency of lamellae, presence of lamellulae, colour and type of lamellae edge; presence of annulus; insertion, consistency, apical colour, basal shape and shape of stipe, development of subiculum; context thickness; acridity, presence of bitter taste, presence of latex) and seven characters for macrochemical tests (SV, FeSO4, Gaiac, Phenol, Anilin, NH4OH, KOH), 45 microscopic features (amyloidity and localisation of amyloidity on plage, shape and base of spore ornaments, height of connections between ornaments, degree of reticulation, number of sterigmata; shape, apical shape, branching, wall thickness, emergence, contents and SV-sensitivity of macro- and pseudo-pleurocystidia; shape, apical shape, septation and wall thickness for marginal cells; type of subhymenium and hymenophoral trama; degree of gelification, presence of thick-walled elements, presence of inflated cells, orientation of extremities for pileipellis; shape and ramification of terminal elements in pileus; distribution, SV-sensitivity, metachromatic reaction in cresyl blue and septation of pileocystidia; presence of extra-and intracellular pigmentation; presence of thick-walled elements, presence of inflated cells and orientation of extremities for stipitipellis; shape and ramification of terminal elements in stipe) and for 6 ecological features (principal biological form, vegetation density, tree-type, degree of humidity, texture, acidity of soil).

C-comparisons (for categories) were designed for discrete ordered or unordered multistate variables when several fields make up a single character (e.g. "pileus color" has 9 fields). Codes 0, 1 and 2 were used with code 1 for intermediate states.

C-comparisons were used to describe taste, smell, colour of pileus (fresh and in exsiccatum), colour of lamellae, colour of stipe, colour of latex (fresh, dried and after exposure to air), colour change of context in stipe and elsewhere on basidiome, abundance of macro- and pseudo-pleurocystidia, maximal height of spore ornamentation, presence of clamp connections, substratum, climate and continent.

D-comparisons (for degree) were designed for discrete ordered or unordered and for some continuous variables, such as spore print colour. Values between 0 and 999.99 were coded for this character.

D-comparisons were used for spore print colour using the data from the colour charts proposed by Romagnesi (1967) and Dagron (1993).

For all comparisons, a code of -1 was used when data were unavailable (choosing "?").

Intermediate characters states were interpreted by the program as selecting for more than one character state.

A number of useful characters were not included in the data files because of the enormous amount of data that is missing from existing descriptions (see below). In some cases, it was better to retain different kinds of information on a particular feature until a satisfactory solution is found in the future.

Missing data

The identification of a specimen using ALLRUS is the result of a more or less perfect match between its features and those contained in a particular description (or taxon) encoded in the reference data file. When comparing the data set of a specimen with a data set of a description contained in the reference file, ALLRUS ignores all characters that are missing in at least one of the two data sets under comparison. Unless the user restricts the number of reference species that will be compared for the identification, the character set of the specimen is compared with every description or species contained in the reference file.

The result of these comparisons is a listing of similarities for all compared descriptions in descending order. Because the reliability of the identification depends on the number of characters that were actually compared in each case, ALLRUS indicates the number of character comparisons that support each similarity. It is evident that a 95 % similarity resulting from 143 character comparisons is much more informative than a 95 % similarity based on 32 character comparisons.

Reliable identification is possible on the conditions that :

1. the data-set is complete for as many characters as possible,
2. characters are described unambiguously or quantitatively. It is possible to replace vague descriptive terminology with objective, quantitative data. For example, spore size can be based on statistical measurements and the number of pleurocystidia can be estimated following Buyck (1991),
3. mycologists come to some agreement on the validity of the chosen character set and their attributes for a standardized presentation format of the information contained in descriptions.

The identification of *Russula*, or any other basidiomycete for that matter, can hardly be as reliable as it is for yeasts and many micromycetes because the descriptions of macromycetes contain many more missing or ambiguous data. The capital problem of any database on macromycetes remains the need of a more complete data set (Fig. 2-4).

The standardization of character set and formats for the description of taxa will contribute significantly to the reliability of identifying of species of *Russula* and other macromycetes. The use of standardized formats for descriptions will facilitate the comparison of morphological and anatomical features between species and the development of a more reliable system of classification.

As far as *Russula* is concerned, it is not possible to make additional assumptions on features without new observations of original material or without adding from other sources (Robert and Buyck, 1995). Our data set is not composite, meaning that the description of taxa are not composed of a mix of data obtained from various sources. We only encoded individual descriptions from literature, often several descriptions for the same species, without combining them into one and the same description.

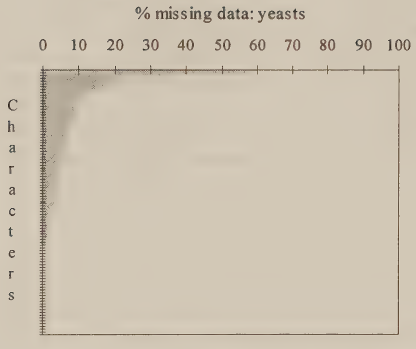


Fig. 2. Percentages of missing data for yeast species. Statistics based on 643 descriptions of species and 94 characters (mostly physiological) from Barnett et al. (1990) and Kreger-van Rij (1984). Missing in grey color.

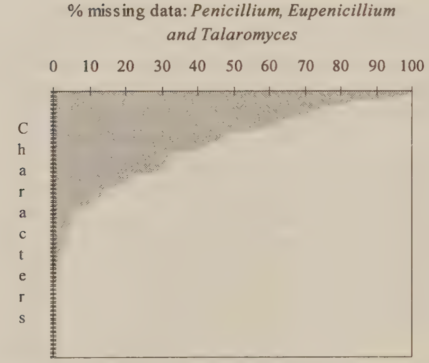


Fig. 3. Percentages of missing data for *Penicillium, Eupenicillium* and *Talaromyces* species based on 150 descriptions and 129 characters from Pitt (1979). Missing in grey color.

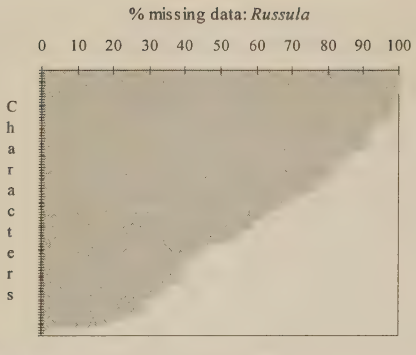


Fig. 4. Percentages of missing data in *Russula* species based on 609 descriptions and 143 characters. Missing in grey color.

A data file covering the whole range of morphological-anatomical-physiological features of any genus of macromycetes is an utopia. Waiting for new examination of all original material and new specimens of every species on which to base new and “complete” descriptions is not only unrealistic, but will never cover the whole range of variation for the features of each species. Completing the descriptions in a practical way will inevitably require composite morphological-anatomical-physiological data sets for the taxa by assembling data for the involved species from different sources. Even when performed by a "specialist" of the group at hand, there remains an inherent danger of mixing data sets that apply to different taxa. ALLRUS guarantees complete transparency with information gathered from different sources by giving the possibility to indicate the original source for each individual feature (or set of features) in the data file ("using "sensu author").

The software

The established reference data file constitutes the basic information used by the specifically designed identification software, which has been developed for IBM-PC in Borland C++ and CA-Visual Objects for Windows. Powerful executable programs (.EXE) assure easy data handling and file management. In addition, CA-Visual Objects can use the same type of files as dBase. The management of these files can be done using dBase, FoxPro, Access or MS-Excel making it possible to also use the same data set for statistical or other purposes. The coding and reading of data is done by making the appropriate selection from a succession of chosen submenus. It does not require memorizing codes or character states since all information is displayed on screen or can be consulted through help-menus. The time necessary for coding a species description varies from 30 minutes to one hour depending on the complexity of the description. The coding of a strain is much quicker.

A similar software, ALLEV, was developed for the identification of yeasts (Robert et al., 1994) and after a testing period of nearly two years, we can safely state that the reliability of the performed identifications is excellent. The identification process is almost instantaneous for yeasts and within seconds for *Russula*.

ALLRUS offers a completely transparent working environment since all of the information contained in the data files is accessible to the user. Furthermore, the results of identification can be checked or interpreted on screen or printed out for every character or species for re-interpretation. This allows a correct interpretation of the results obtained. ALLRUS also permits the user to define most discriminant characters, attribute different weights to selected characters, carry out step-by-step selections on successively narrower groups of species, modify, add or delete information contained in any of the data files (one is allowed to create additional reference files), produce ASCII-files for numerical analysis or for statistical operations with other software, consult in separate windows scanned illustrations of macroscopic and microscopic features for any *Russula* at any given moment during access of the data file or after an identification or search action has been performed, create a species concept by merging characteristics of several strains, compute percentage of missing data per character or per species, manage a literature by adding, deleting, searching or ordering publications by various key words, etc.

Comments, suggestions or criticism on this project may be sent to either one of the authors of the present paper.

Acknowledgements

We sincerely thank Andrew S. Methven, Timothy J. Baroni and Grégoire L. Hennebert for their reviews and comments.

Our thanks are also extended to Henri Romagnesi, Annemieke Verbeken, Wendy Untereiner and Richard P. Korf for discussing character selection and coding and for correcting the manuscript.

Literature cited

Adhikari, M.K. 1988. The genus *Russula* from the Kathmandu Valley. In Watanabe, M. and Malla, S.B. (Eds.), *Cryptogams of the Himalayas.* vol. 1.

Adhikari, M.K. 1990. The genus *Russula* from Nepal (II). In Watanabe, M. and S.B. Malla (Eds.), *Cryptogams of the Himalayas. Central and Eastern Nepal.* vol 2: 101-112. Tsukuba, Japan: Dept. of Botany, Nat. Sci. Mus. 1990.

Barnett, J.A., Payne, R.W. and Yarrow, D. 1990. *Yeasts: characteristics and identification, ed. 2.* Cambridge. 1002 pp.

Bills, G.F. 1984. Southern Appalachian *Russula* II. *Mycotaxon* 21: 491-517.

Bills, G.F. 1985. Southern Appalachian *Russula* III. *Brittonia* 37(4): 360-365.

Bills, G.F. 1986. *Russula vesicatoria* and *Russula angustispora* sp. nov. two confusing species of *Russula* subsection *Lactarioidae*. *Mycotaxon* 26(2): 607-620.

Bills, G.F. 1989. Southern Appalachian *Russula* IV. *Mycologia* 81(1): 57-65.

Bills, G.F., Miller, O.K. 1984. Southern Appalachian *Russula* I. *Mycologia* 76: 975-1002.

Blum, J. 1962. *Les russules. Flore monographique des russules de la France et des pays voisins.* P. Lechevalier, Paris. 229 pp.

Burlingham, G.S. 1913. The *Lactarioidae* of the Pacific coast. *Mycologia* 5: 305-311.

Buyck, B. 1988. Etude microscopique de spécimens-types de Russules tropicales de la sous-section *Diversicolores. Mycotaxon* 33: 57-70.

Buyck, B. 1990. *Révision du genre Russula en Afrique Centrale.* Thèse de doctorat, Rijksuniversiteit Gent. 590 pp.

Buyck, B. 1991. The study of microscopic features in *Russula*. 2. Sterile elements of the hymenium. *Russulales News* 1(2): 62-85.

Buyck, B. 1993. *F. Ill. Champignons Afri. Centr.* 15: 335-408, pl. 55-68.

Buyck, B. 1994. *F. Ill. Champignons Afri. Centr.* 16: 409-539, pl. 69-87.

Buyck, B. 1995. *F. Ill. Champignons Afri. Centr.* 17: 540-000, pl. 88-93. (in press).

Chiu, W-F. 1945. The *Russulaceae* of Yunnan. *Lloydia* 8(1): 31-59.

Dagron, Ch. 1993. A new color chart for the precise determination of spore print colour in *Russula*. *Russulales News* 2: 50-51.

Einhellinger, A. 1985. *Die Gattung Russula in Bayern*. Hoppea, Denkschr. Regensb. Bot. Gesell. 43. 348 pp.

Härkönen M., Buyck B., Saarimäki T. and Mwasumbi L. 1993. Tanzanian mushrooms and their uses 1. *Russula*. *Karstenia* 33: 11-50.

Heim, R. 1938. *Les Lactario-Russulé du domaine oriental de Madagascar, un essai sur la classification et la phylogénie des Astérosporales. Prodrome à une flore mycologique de Madagascar et dépendances, I.* Paris. 196 pp.

Hesler, L.R. 1960. A study of *Russula* type. *Mem. Torrey Bot. Club* 21: 1-59.

Hesler, L.R. 1961. A study of *Russula* type. II. *Mycologia* 53: 605-625.

Homola, R.L. and Shaffer, R.L. 1975. A new *Russula* of the subsection *Nigricantes* from Northeastern North America. *Mycologia* 67: 428-434.

Hongo, T. 1955. Notes on Japanese larger fungi (6). *Journ. Jap. Bot. Vol.* 30 (3): 73-79.

Hongo, T. 1968. Notulae Mycologicae (7). *Mem. Shiga Univ. Nat. Sci.* 18: 47-52.

Kauffman, C. H. 1908. Unreported Michigan Fungi for 1908, with a monograph of the *Russula*s of the State. *Mich. Acad. Sc.* 11: 55-91.

Kreger-van Rij, N.J.W. 1984. *The yeasts a taxonomic study, third and enlarged ed.* Elsevier Science Publishers, Amsterdam. 1082 pp.

Kühner, R. 1975. Agaricales de la zone alpine. Genre *Russula* Pers. ex. S.F. Gray. *Bull. Soc. Mycol. France* 91(3): 313-390.

Marchand, A. 1977. *Champignons du Nord et du Midi. V. Les Russules*. Hachette. 303 pp.

Murrill, W.A. 1916. Illustrations of fungi. - XXIII. *Mycologia* 8: 121-124.

Pankhurst, R.J. 1975a. Identification by matching. In: R.J. Pankhurst (ed.), *Biological Identification with Computers*. Academic Press, London and New York. 79- 91.

Pankhurst, R.J. 1975b. Identification Methods and the Quality of Taxonomic Descriptions. In: R.J. Pankhurst (ed.), *Biological Identification with Computers.* Academic Press, London and New York. 237-247.

Pitt, J.I. 1979. The genus *Penicillium* and its teleomorphic states *Eupenicillium* and *Talaromyces*. Academic Press, London. 634 pp.

Robert, V. and Buyck, B. 1994. Missing data in mycology. *Abstr. 5th Mycol. Cong. Vancouver.*

Robert, V. and Buyck, B. 1995. Missing data on European *Russula*. *Russulales News.4*.. 91 pp.

Robert, V., de Bien, J.-E., Buyck, B. and Hennebert, G.L. 1994. ALLEV, a new program for computer-assisted identification of yeasts. *Taxon* 43: 433-439.

Robert, V and E. Le Boulengé. 1996. Some algorithms for identification and classification purposes. *In prep.*

Romagnesi, H. 1967. *Les russules d'Europe et d'Afrique du Nord.* Bordas, Paris. 1028 pp.

Sarnari, M. 1984. Genere *Russula.* Le *Plorantinae* a spore colorate. *Boll. Gruppo Mic. G. Bresadola* 27: 117-124.

Sarnari, M. 1991. *Russula* nuove o interessanti dell'Italia centrale e mediterranea-XIV contributo. *Boll. Amer.* 23(2): 7-17.

Sarnari, M. 1992. *Russula* nuove o interessanti dell'Italia centrale e mediterranea-XVI contributo. *Boll. Amer.* 26(2): 27-32.

Sarnari, M. 1993. Russule nuove o interessanti dell'Italia centrale e mediterranea. XIX contributo. *Rivista Mycol.* 36: 37-54.

Schaeffer, J. 1952. *Russula-Monographie.* Verlag Julius Klinkhardt, Bad Heilbrunn Obb. 296 pp.

Shaffer, R.L. 1962. The subsection *Compactae* of *Russula. Brittonia* 14: 254-284.

Shaffer, R.L. 1964. The subsection *Lactarioidae* of *Russula. Mycologia* 56: 202-231.

Shaffer, R.L. 1970a. Cuticular terminology in *Russula* (Agaricales). *Brittonia* 22: 230-239.

Shaffer, R.L. 1970b. Notes on the subsection *Crassotunicatinae* and other species of *Russula. Lloydia* 33: 49-96.

Shaffer, R.L. 1972. North American *Russula* of the subsection *Foetentinae. Mycologia* 64: 1008-1053.

Shaffer, R.L. 1975. Some common North American species of *Russula* subsection *Emeticinae. Beih. Nova Hedwigia* 51: 207-229.

Shaffer, R.L. 1989. Four white-capped species of *Russula* (*Russulaceae*). *Mem. N.Y. Bot. Grdn* 49: 348-354.

Shaffer, R.L. 1990. Notes on the *Archaeinae* and other *Russula. Contr. Univ. Mich. Herb.* 17: 295-306.

Singer, R. 1938. Contribution à l'étude des Russules (1). 3. Quelques Russules américaines et asiatiques. *Bull. Soc. Mycol. France* 54: 132-177.

Singer, R. 1939. Contribution à l'étude des Russules (1). 4. Quelques Russules américaines et asiatiques (suite). *Bull. Soc. Mycol. France* 55: 226-232.

Singer, R. 1950. Les Russules de l'Argentine. *Rev. Mycol.* 15: 125-137.

Singer, R. 1957. New and Interesting species of Basidiomycetes V. *Sydowia* 11: 141-272.

Singer, R., Araujo, I. and Ivory, M.H. 1983. The Ectotrophically Mycorrhizal fungi of the Neotropical Lowlands, especially Central Amazonia. *Beih. Nova Hedwigia* 77: 1-352.

Thiers, H.D. 1994. The subgenus *Compactae* of *Russula* in California. *Mycol. Helv.* 2: 107-120.

MYCOTAXON

Volume LX pp. 481-484 October-December 1996

HELICOON SEPTATISSIMUM SP. NOV. , A NEW SPECIES FROM TIERRA DEL FUEGO (ARGENTINA)

A. M. Godeas* and A. M. Arambarri**

* Departamento de Ciencias Biológicas. Facultad de Ciencias Exactas y
Naturales. Universidad de Buenos Aires. 1428. Buenos Aires. Argentina.
** Instituto Spegazzini, Universidad Nacional de La Plata. Calle 53. Nro. 477.
La Plata. 1900 Buenos Aires. Argentina.

ABSTRACT

A previously undiscovered species of a helicosporous Hyphomycetes, namely *Helicoon septatissimum,* collected in Tierra del Fuego, Argentina, is described, illustrated and compared with similar, previously known taxa.

Exsiccata are available at the Spegazzini Institute.

INTRODUCTION

A ten year survey of anamorphic micro fungi growing on wood in Tierra del Fuego, Argentina, have led to the discovery of previously undescribed species (Arambarri & Godeas, 1994a,b). In the present contribution an additional species of *Helicoon* is reported.

MATERIALS AND METHODS

Wood samples were collected under the surface of slow running streams. This material was rinsed in tap water and kept damp, but not submerged, in closed Petri dishes and exposed to light. After 7 days, glistening spores appeared on the surfaces.

When examined under microscope, these were seen to contain helicoid spores. The coiled conidium was unsinkable, a bubble of air at the centre of the coils acting as a flotation device when submerged.

TAXONOMIC PART

Helicoon septatissimum Godeas & Arambarri sp. nov.

Coloniae in naturae inconspicuae. Mycelium plerumque superficialis, hyphis brunneo-fuscis, septatis, 3-3.8 µm diam.; hyphis aereae laevis. Conidiophora simplicia, erecta, septata, 40-120 x 4.5 µm, saepe in apice recurvata, subhyalina. Cellulae conidiogenae terminales, blasticae, denticulatae. Conidia solitaria, siccae, cochleata, cum 9-14 gyris, hyalina vel pallide brunnea, doliiformis, 70-75 x 40-45 µm.

Holotypus: Argentina. Fueguiae. Departamento de Ushuaia. Bahia Ensenada. Leg. A. Godeas. 3-94, ad ligna putrida *Nothofagi betuloides.* In Herb. LPS 45382 conservatus est.

Etimology: with the most septate conidial filament.

Colony on natural substrate inconspicuous. ***Mycelium***, mostly superficial, composed of dark-brown, septate hyphae, 3-3.8 µm diam; aerial hyphae smooth. ***Conidiophores***, semimacronematous, mononematous, 40-120 x 4.5 µm, simple, erect, straight, sometimes curved at the apex, septate, subhyaline. ***Conidiogenous cells*** holoblastic, integrated, terminal, determinate, denticulate. ***Conidia,*** solitary, dry, acrogenous, at first hyaline, becoming light brown. Conidial filament 8.0 - 10.0 µm diam., multiseptate (up to 30 septa each coil), tightly coiled 9-14 times in three planes to form a doliiform conidium 70-75x 40-45 µm (**Fig. 1**).

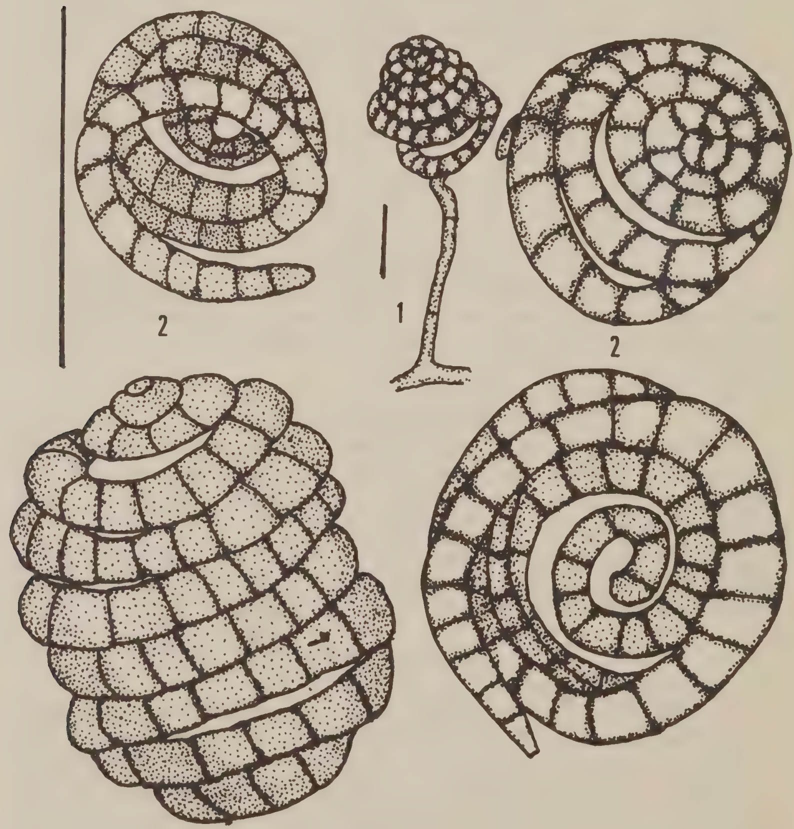


Fig. 1: *Helicoon septatissimum*; 1.- Conidiophore and conidia. 2.-Conidia. Bars 1 and 2 indicate 50µm

Substrate: On decaying wood of *N. betuloides* under water surface in a slow running stream.

Distribution: Argentina, Tierra del Fuego. Bahia Ensenada.

DISCUSSION

Our species can be placed in the *genus Helicoon* establised by Morgan, 1892; who accommodated those helicosporus Hyphomycetes characterized by the production of non-proliferating, cylindrical, barrel shaped conidia. The conidia are borne on distinct conidiophores which may be very short and inconspicuous. No teleomorph of *Helicoon* is known.

Linder (1929), recognized 7 species for *Helicoon* whereas Moore (1955) and Goos (1987), acepted 9 species for the genus.

A revision of the anamorphic genus *Helicoon* (Goos et al, 1986) determined 8 species for the genus characterized by the diameter of the conidium filament, the number of conidial coils, colour, size and shape of the conidium and conidiophore and conidium size, .

Helicoon septatissimum is included in the **table 1** with the diagnostic characteristics of the species of *Helicoon*, the substrate where they grow and the distribution.

The closest species is *H. richonis* but it has black conidia and the conidial filament is less septate than *H septatissimum.*

REFERENCES

Arambarri, A. M. & A. M. Godeas, 1994. *Edmundmasonia gamundiae* sp. nov. A new Hyphomycete from Tierra del Fuego (Argentina). Mycotaxon 52: 91-94.

Arambarri, A. M. & A. M. Godeas, 1994. *Menispora fuegiana* sp. nov. A new Hyphomycete from Tierra del Fuego (Argentina). Mycotaxon 52: 95-98.

Goos, R. D., 1987. Fungi with a twist: The Helicosporous Hyphomycetes. Mycologia 79: 1-22.

Goos, R. D., S. K. Abdullah, P. J. Fisher and J. Webster. 1986. The anamorph genus *Helicoon*. Trans. Br. Mycol. Soc. 87:115-122.

Linder, D. H., 1929. A monograph of the Helicosporous Fungi Imperfecti. Ann. Missouri Botanical Garden 16: 227-388.

Moore, R. T., 1955. Index of the Helicosporae. Mycologia 47: 90-103.

Morgan, A. P., 1892. North American Helicosporae. Jour. Cincinnati Soc. Nat. Hist. 15: 39-52.

ACKNOWLEDGEMENT

The authors gratefully acknoledge Dr. J. E. Wright (U. de Buenos Aires, Argentina) for his critical pre-publication rewiew of the manuscript and help with the latin diagnosis. Also we thank to Dr. J. Webster (U. Exeter, England) for confirming the new species.

Our research has been supported by a grant from the CONICET (Consejo Nacional de Investigaciones Científicas y Técnicas) as part of the project "Flora Criptogámica de Tierra del Fuego".

Species	Conidium colour	Conidium filament (um)	Number of coils	Conidium size (um)	Conidiophore size (um)	Shape	Substrate	Distribution
H. auratum	y	2.5-3.6	8-16	14-27x36-45	32-150x3.5-5.5	ovoid-elliptical	wd	U.S.A.
H. chlamydosporum	f	3.0-4.0	4-5	14-17x15-18	15-90x3.5-4.5	globose-subglobose	wd,ls,s,d	England
H. ellipticum	lb	3.0-5.5	6-12	18-32x28-45	-800x 4.5-5.5	ellipsoidal	wd,ls	U.S.A, England,Sweden, New Zealand.
H. farinosum	w	3.5-4.5	5-8	20-27x22-37	15-45x2.5-4.0	ellipsoidal-globose	wd	U.S.A., England
H.fuscosporum	f	2.7-4.5	6-12	17-25x20-50	-200x4.5-5.0	ellipsoidal-oval	ls	U.S.A, England, Sweden, Argentina, Netherlands
H.pluriseptatum	f	5.0-6.0	4-6	30-42x22-30	5-120x3.0-3.5	ovoid	ls	England, Netherlands
H. richonis	b	6.0-10.0	8-10	50-87x50-62	20-150x4.5	oval	wd,ls	Canada, England, France, Netherlands
H. septatissimum	lb	8.5-10.0	9-14	70-75x40-45	40-120x4.5	doliiform	wd	Argentina
H. sessile	w	4.5-6.5	5-16	23-30x33-59	1-50x4.5	ellipsoidal	wd,ls,tw,	U.S.A., England

Colour: y: yellow; f:fuscous; lb:light brown, w:white; y:yellow
Substrate: wd: wood, ls: leaves; s:soil; d:dung; tw:twigs

Table 1: Principal characteristic of species of *Helicoon*

MYCOTAXON

Volume LX, pp. 485-490 October-December 1996

A NEW SPECIES OF *LEPTODONTIDIUM* FROM *QUERCUS ACUTISSIMA*

A. TSUNEDA[1], N. MAEKAWA[1] and R.S. CURRAH[2]

[1]Tottori Mycological Institute, Kokoge 211,
Tottori 689-11, Japan
and
[2]Department of Biological Sciences, University of Alberta,
Edmonton, Alberta T6G 2E9, Canada

ABSTRACT

A new dematiaceous hyphomycete, *Leptodontidium quercuum*, is described. This species is characterized by the formation of darkly pigmented clusters of chlamydospores in *Quercus* wood and on agar media. This taxon most closely resembles *L. orchidicola* in forming similar chlamydospores but differs in producing colonies which have a rusty brown cast, in forming large terminal clusters of conidia, and in being found in wood rather than in living roots.

KEY WORDS: *Leptodontidium*, *Quercus*, chlamydospores, taxonomy.

INTRODUCTION

The dematiaceous hyphomycete genus, *Leptodontidium* de Hoog, is characterized by gray to black funiculose colonies, hyaline conidiogenous cells, and small conidia formed more or less sympodially (de Hoog, 1977; 1979). Six species were described by de Hoog (1977, 1979), treating *L. elatius* (Magenot) de Hoog as the type, and three other

---

Paper No. 305. of the Tottori Mycological Institute.

species were subsequently added (Rao and de Hoog, 1986; Currah et al., 1987; Castañeda Ruiz, 1988). We report herein a previously undescribed species of *Leptodontidium* from logs of *Quercus acutissima* Carruth., that had been used in the cultivation of Shiitake, *Lentinula edodes* (Berk.) Pegler, in Japan.

MATERIALS AND METHODS

Three strains of the fungus were studied and deposited in the Tottori Mycological Institute (TMI): TMI 32391, the ex-type strain, isolated from wood of *Q. acutissima*, Kikuchi city, Kumamoto prefecture; TMI 32392, from wood of *Q. acutissima*, Saigo-son, Miyazaki pref.; and TMI 32420, from wood of *Q. acutissima*, Morotsuka-son, Miyazaki pref. Subcultures of these strains are in the University of Alberta Microfungus Collection and Herbarium, UAMH. In addition, two strains of *L. orchidicola* Sigler & Currah (UAMH 5422, from roots of *Platanthera hyperborea* (L.) Lindl., and UAMH 8151, from roots of *Artemisia norvegica* Fries, both collected in Alberta, Canada) were examined for comparison.

All of these strains were grown on potato dextrose agar (PDA, Difco, Detroit), corn meal agar (CMA, Difco), or malt extract agar (MEA, Difco) at 20°C in the dark. Wood samples were hand-sectioned for light microscopy (LM). Specimens for scanning electron microscopy (SEM) were prepared using the method described in Tsuneda et al. (1991).

DESCRIPTION

Leptodontidium quercuum Tsuneda, Maekawa & Currah, sp. nov.

Figs. 1–9.

In cortice interiore et alburno exteriore truncorum quercus, mycelium sterile, inconspicuum alburnum exterius ab eo discoloratum brunneum videtur. Chlamydosporae forma irregulares, fusce pigmentatae, crasse tunicatae, praecipue crescentes in vasibus trachiisque, et ibi texturas scleroticas brunneas vel nigras formantes. In PDA, coloniae griseae vel rubro-brunneae, cum margine lata, alba, submersa et cum mycelio aerio coacti-formi olivario vel rubro-brunneo, post 8 dies propre 20°C ad 63 mm diam attingentes. Propre 25°C incrementum multo tardius et propre 30°C fere abest. Cellulae conidiogeneae a hyphis indifferentiatis orientes, hyalinae ad pallide brunneae, lenes, breves, nodo-formes vel longe cylindratae, plerumque 2–3 μm latae et 1–25 μm longae directaeque, tenuiter curvatae vel flexuosae, septatae vel aseptatae. Conidia sympodialia vel maifeste phialidia, hyalina, lenia, tenuiter tunicata, subglobosa ad ellipsoidea, pyriforma, rare breviter stipitata, 2.4–4 x 2.2–3.2 μm, glomus terminale e duobus vel ad 20 vel pluribus formantia. Chlamydosporae crassiter tunicatae, irregulariter formatae, aggregationes densas vel strata texturae scleroticae formantes. In CMA pigmentatio tarda. Holotypus: colonia exsiccata ex TMI 32391, ex ligno Quercus acutissima Japoniensis, TMI.

ETYMOLOGY: Occurring on *Quercus*.

Mycelium in the natural substrate inconspicuous, spreading in the inner bark and outer sapwood regions, changing the color of sapwood to grayish brown. Conidia not found in the natural substrate. Chlamydospores, irregular in shape, darkly pigmented, thick-walled, occurring primarily in vessels and tracheids (Fig. 1), often becoming tightly packed to form brown to black sclerotic tissues. Colonies on PDA attaining 51–63 mm diam at 20°C in 8 days (varying with the strain; daily growth rate between 5th and 8th days = 3.9–4.6 mm/day), much slower at 25°C, almost no growth at 30°C, grayish or reddish brown, margin broad, submerged, white (Fig. 2); aerial mycelium, felted, initially white becoming olive to reddish brown with age. Reverse black when aged. Hyphae septate, often producing brown exudates (Fig. 3), submerged hyphae olive to dark brown. Conidiogenous cells, arising from undifferentiated hyphae, hyaline to pale brown, smooth, short knob-like (Fig. 4) to long cylindrical (Fig.7) often slightly tapered at the tip, mostly 2–3 μm thick and 1–25 μm long, straight, slightly bent or sometimes flexuous (Fig. 5), with or without thin septa. Conidiogenesis either sympodial (Figs. 4–6) or apparently phialidic (Fig. 7). Conidia hyaline, smooth, thin-walled, subglobose to ellipsoid, pyriform, rarely short-stipitate, 2.4–4 x 2.2–3.2 μm, forming a terminal cluster of a few to 20 or more conidia (Figs. 4–7). Chlamydospores thick-walled, irregularly shaped, forming aggregated masses (Figs. 8, 9) or a dense layer of sclerotic tissue. On CMA pigmentation of colonies and chlamydospore production retarded.

Holotype: a dried colony on PDA from TMI 32391, from wood of *Quercus acutissima* from Japan, deposited in TMI.

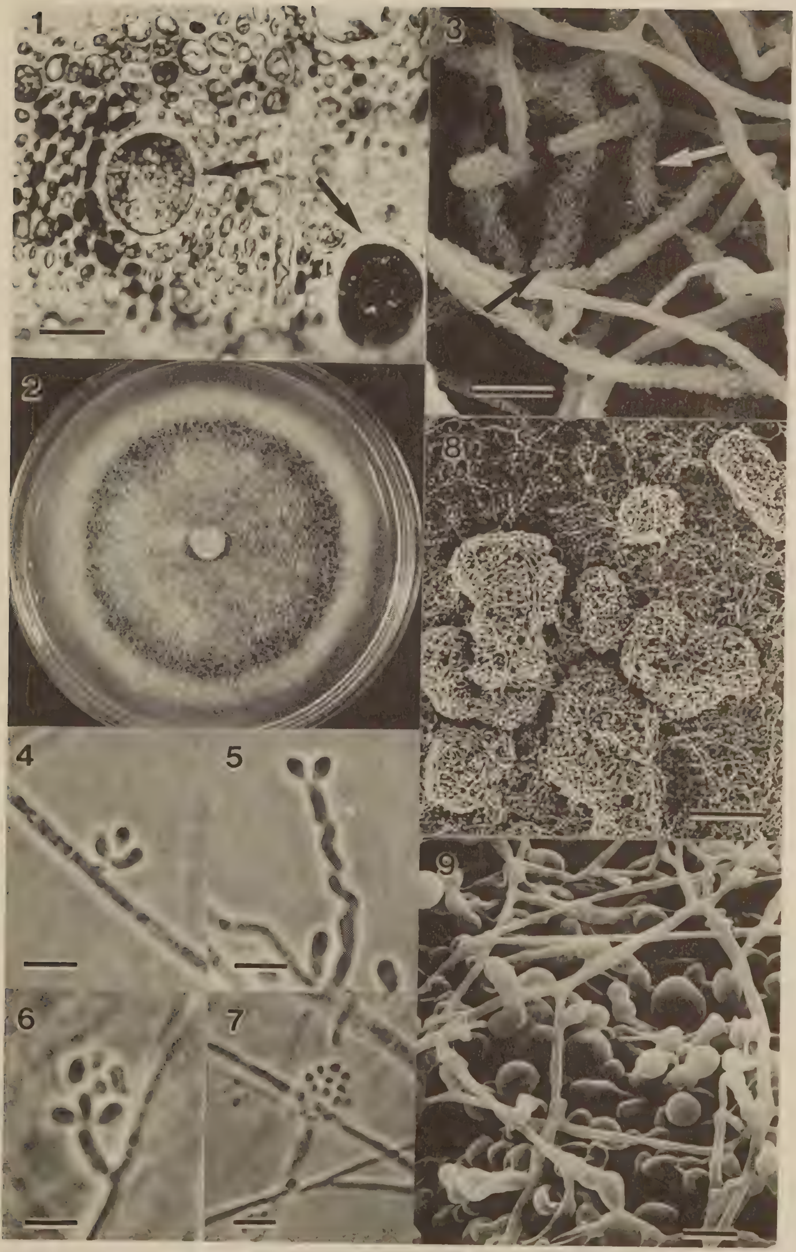
DISCUSSION

Leptodontidium quercuum and *L. orchidicola* are unique in the genus in producing chlamydospores that can form sclerotic clusters of cells on solid media and intracellularly in plant host tissues. In *L. quercuum*, the sclerotic tissue develops and forms a narrow, dark demarcation line in wood apparently in response to the approach of the mycelium of *Lentinula edodes*. Similar aggregations develop in root cortical cells infected by *L. orchidicola* (Currah et al., 1987). Sclerotic tissue develops in agar culture of both *L. quercuum* and *L. orchidicola* as colonies age. Chlamydospores are also formed by *L. irregulare* (de Hoog) de Hoog but these are ellipsoidal, reddish brown and solitary or in short chains (de Hoog, 1977). *Leptodontidium irregulare*, like *L. quercuum*, is known from wood but the morphology and disposition of the mycelium in or among xylary elements is unknown.

Leptodontidium quercuum and *L. orchidicola* differ substantially with respect to their natural habitat and the pattern in which conidia are borne on conidiogenous cells. The latter is known only from roots of a wide range of plants native to cool temperate regions where soils are rich in organic debris. Our isolates of *L. quercuum* are all from wood. Conidiogenesis in *L. orchidicola* involves the production of solitary lateral conidia measuring 1–3 x 3–6 μm on conidiogenous hyphae. Occasionally a few conidia will develop sympodially in clusters at the

---

Fig. 1. Transverse section of outer sap wood of *Quercus acutissima* containing sclerotic tissues of *Leptodontidium quercuum* in vessels (arrows) and tracheids. Sclerotic tissues become black when aged. Fig. 2. Colony of the ex-type strain (TMI 32391) on PDA, 2 weeks at 20°C. Fig. 3. Hyphae surrounded with exudates (arrows). Figs. 4–7. Sympodial (4-6) or apparently phialidic (7) conidia formed on conidiogenous cells of different length. PDA, 3 months at 20°C. Figs. 8 and 9. Masses of chlamydospores developed on MEA and their enlarged view. 3 months at 20°C. Bars = 200 μm in Fig. 1; 300 μm in Fig. 8; 10 μm in Figs. 3–7 and 9.


1
2
3
4
5
6
7
8
9

apex of conidiogenous cells. The process in *L. quercuum* results in the formation of few- to many-spored clusters of conidia, 2.4–4 x 2.2–3.2 μm, at the apex of conidiogenous cells. Conidia develop sympodially although when large clusters of conidia are observed they appear to have originated phialidically. The mode of origin of these larger clusters has yet to be clarified. Unlike *L. orchidicola*, laterally borne conidia are rare. *Leptodontidium orchidicola* generally sporulates readily in culture although conidia may be few and inconspicuous, whereas *L. quercuum* requires several months incubation before conidia will appear.

Acknowledgements: We thank Dr. Michael Hertwig, University of Alberta, for kindly providing the latin description, and Dr. D. Malloch, University of Toronto, for reviewing the manuscript.

LITERATURE CITED

Castañeda Ruiz, R.F. 1988. Fungi Cubenses III. Publ. Inst. Invs. Fund. Agric. Trop. “Alejandro de Humboldt,” pp. 27.

Currah, R.S., L. Sigler, and S. Hambleton. 1987. New records and new taxa of fungi from the mycorrhizae of terrestrial orchids of Alberta. Can. J. Bot. **65**: 2473–2482.

De Hoog, G. S. 1977. *Rhinocladiella* and allied genera. *In* Studies in mycology. No. 15. Centraalbureau voor Schimmelcultures, Baarn. pp. 140.

De Hoog, G. S. 1979. Nomenclatural notes on some black-yeast like hyphomycetes. Taxon **28**: 347–348.

Fernando, A.A. and R.S. Currah. 1995. *Leptodontidium orchidicola* (*Mycelium radicis atrovirens* complex): aspects of its conidiogenesis and ecology. Mycotaxon **54**: 287–294.

Rao, V. and G.S. de Hoog. 1986. New or critical Hyphomycetes from India. *In* Studies in mycology. No. 28. Centraalbureau voor Schimmelcultures, Baarn. pp. 84.

Tsuneda, A., N. Maekawa, I. Ohira, and I. Furukawa. 1991. Incipient decay of *Quercus serrata* sapwood and its inhibition by an antagonistic hyphomycete, *Leptodontidium elatius*. Can. J. Bot. **69**: 2797–2805.

MYCOTAXON
Volume LX, pp. 491-496 October-December 1996

BOOK REVIEWS

D. S. Hibbett, Book Review Editor

Ainsworth & Bisby's Dictionary of the Fungi, Eighth Edition, edited by D. L. Hawksworth, P. M. Kirk, B. C. Sutton, and D. N. Pegler. 250 x 175 mm, 632 pp, 1995. CAB International, Marketing Department, Wallingford, Oxon OX10 8DE, UK. Fax: (01491) 833508, e-mail: cabi@cabi.org. ISBN 0-85198-885-7. US$ 49.95.

The 8th edition of the **Dictionary of the Fungi** is everything the editors hope for (p. vii), "A marvelously imperfect work needed by all." The core work is indeed a marvel of a dictionary. For over a half-century the editorial format of the **Dictionary** has been similar to the definition of the term in **Webster's New World Dictionary of the American Language**: "A record of generally accepted meanings, pronunciations, etc. which the words listed in it have acquired up to the time of its publication." The historical mission of the **Dictionary** has been to provide logically indexed access to mycological literature. The editions under the editorial guidance of G. C. Ainsworth and G. R. Bisby stand for the most part as reputable, authoritative, and reliable resources for the mycological expert, the general user and the public at large.

At best the 8th edition continues to be a thorough record of terms in mycological literature that spans over 200 years. Mycological specialists from all over the world will be able to critically read entries reflecting both familiar and unfamiliar topics. However, the 8th edition will be accepted uncritically by the nonspecialist user and especially by the general public.

As the editors predict, the 8th edition is imperfect. The use of terminology is inconsistent. The taxonomy is misleading. The touted hypothesis-testing skepticism (p. xii) is especially needed for features such as the classification scheme, the "accepted" taxa, and the "longer entries." More in the fashion of an encyclopedia than a dictionary, the 8th edition contains a noticeable increase in the interpretations of mycological concepts from the viewpoint of the editorial staff.

Two ascomycete examples are illustrative of imperfection. A boasted innovation is the abandonment of "the deuteromycetes as a formal systematic category and [the editors endeavor] to incorporate them in the system of ascomycetes and basidiomycetes...(p. vii)." The 8th edition makes a bold attempt to clarify the ideological muddle surrounding the terminology of Article 59 of the **International Code of Botanical Nomenclature** that was contrived for naming pleomorphic species. Nevertheless, the definitions of terminology for pleomorphic species found in **Introductory Mycology, 4th edition** by Alexopoulos, Mims, and Blackwell (1996; see review in **Mycotaxon** vol. 58, 1996) are more precise and useful than those provided in the **Dictionary**. The 8th edition definition of the fungal holomorph is adapted from the seminal paper of G. Hennebert and L. Weresub in 1977 on nomenclatural terminology, but the later clarification of these terms by Hennebert in **The Fungal Holomorph** is ignored. The term "mitosporic fungus" is introduced as a biological term for the asexual species "to replace the form taxon." Confusing exceptions in terms and definitions are made for the mitosporic species as a holomorph and the asexual morph of a pleomorphic species. The term anamorph is given new meaning: *Phoma* is cited as an "anamorphic Pleosporaceae," *Ascochyta* as an "anamorphic" Dothideales, Mycosphaerellaceae and Leptosphaeriaceae. Yet the mitosporic, i.e. nonpleomorphic, taxa of the same name are not incorporated in the touted "system adapted for the ascomycetes developed in collaboration with O. E. Eriksson." Purely mitosporic genera such as *Septonema* are listed along with anamorphic genera such as *Phoma* and *Ascochyta*, as designated by the **Dictionary**, in "a non-systematic category of genera listed alphabetically" (pp. 41, 594).

The authors expound that "Classifications are hypotheses that need a period of testing before they can be commended for general use" (p. vii). The 8th edition is replete with unexplained modification of taxon definition and acceptance and an error laden "hypothetical" classification scheme. The Capnodiaceae is an example of what could be taken as revisionary taxonomy. The family definition (p. 74) ignores the periphysoids described from the type species of *Capnodium* and erroneously cites a paper with this listing of this term that is unrelated to the genus. The description specifies brown ascospores, but the list of genera (p. 545) includes *Scorias* and *Trichomerium* which have hyaline spores. Why are characters recognized in the literature ignored in the 8th edition definition? Several genera such as *Anopeltis* and *Callebaea* are are included in the family list; their individual listing is given as the Capnodiacae with a question mark. What is the basis of this familial revision? What is recommended in the primary literature? *Trichomerium* is listed with 23 species but the cited recent monograph of that taxon recognized one species. What is the basis for the revision of this genus? *Polychaeton* is a final example. This genus was lectotypified by Hughes in 1976 as a name for pycnidial species. The genus is deemed in the 8th edition as a "nom. dub., ? Capnodiaceae." Furthermore, the anamorphic name "*Polychaeton* nom. dub." is listed in the "Systematic Arrangement" under Dothideales, Capnodiaceae!

The classification of basidiomycetes in the 8th edition of the **Dictionary** is similar to that presented in the 6th and 7th editions. The merging of the Gasteromycetes with the Hymenomycetes is a major improvement over earlier editions. The 8th edition is a step backwards, however, with respect to the classification of heterobasidiomycetes. If one relied only on the **Dictionary**, one might think that there has been no progress toward defining natural relationships of heterobasidiomycetes in the last quarter century. This, of course, is not true. The key to the classes, subclasses and orders of Basidiomycota demonstrates why the taxonomy is flawed; the characters which have been given the greatest taxonomic importance include basidium morphology (*sensu* Talbot) and septal ultrastructure.

"By accepting the distinction made by Talbot (1968) between 'primary' and 'adventitious' septa two subclasses may be distinguished" (p. 47). The familiar taxonomy based on this differentiation is retained in the subclass taxa Phragmobasidiomycetidae and Holobasidiomycetidae. However, despite affirming the taxonomic value of this distinction verbatim from the 7th edition (1971), the 8th edition uses this character inconsistently in the resulting taxonomy. The reason for this inconsistent use is that basidial septation has not withstood the test of time as a high level taxonomic character. An example is the family Chionosphaeraceae. *Chionosphaera* and *Fibulostilbum* do not have phragmobasidia whereas *Stilbum* does. It is ironic that a taxonomy based largely on this character would be commended for general use.

Septal ultrastructure is also used to define the higher taxonomic groups of basidiomycetes recognized by the **Dictionary**. Biochemical characters have largely confirmed the value of septal characters for use in higher level systematics. However, numerous, major errors in interpretation of septal ultrastructure have resulted in a nonsensical taxonomy. R. T. Moore was the first to propose that the simple septum of the Uredinales is in fact a reduced dolipore septum. His reinterpretation of the rust septum presumably was sparked by early phylogenetic work using 5S rRNA sequences obtained from so-called rust yeast cultures. In these analyses, the rust fungi grouped with the dolipore-septate hymenomycetes *sensu* Swann (agarics, polypores, Tremellales, etc.). Rust fungi, however, are not known to produce a yeast phase, and it has been known for some time that the yeasts in these studies were actually tremelloid yeasts. Nevertheless, the 8th edition follows Moore's misinterpretation of the ultrastructural morphology of the rust septum, and unfortunately compounds this error by expanding the range of organisms which are said to have this dolipore septum, including the Septobasidiales, Agaricostilbales, Atractiellales (*sensu lato*), and Heterogastridiales. To make matters worse, the latter three orders are said to have parenthosomes associated with these dolipore septa. This is incorrect. None of the organisms in these orders, nor those in the Uredinales, have a dolipore septum, reduced or otherwise.

The **Dictionary** claims that "the analysis underlying the subdivisions used...is pragmatic," and is geared toward the "special interests of many of those who consult this **Dictionary**." This statement suggests that the taxonomy is not meant to be a scientifically sound hypothesis, but rather is designed for ease of use by non-specialists. However, the touted pragmatism is difficult to perceive when the key is consulted. As mentioned above, certain characters cited for particular groups of heterobasidiomycetes are factually incorrect. In other cases the key shows internal conflict of characters, as well as conflict with characters cited in the entries for the taxa. An example is Septobasidiales, which is said to be in the class Teliomycetes. Some of the characters said to define this group are karyogamy by spermatia, dolipore septa, and absence of a basidiome (p. 519). Later in the key, however, the order is differentiated from the Uredinales by the formation of a corticioid basidiome (p. 529). It is also clearly stated in the entry under Septobasidiales (p. 414) that basidiomata are formed by some members of this group.

Persons consulting the taxonomy presented in the **Dictionary** should keep in mind that natural relationships are not necessarily reflected by this classification, nor were they intended to be. The three classes of the Basidiomycota and two subclasses of the Basidiomycetes are polyphyletic. At least five of the heterobasidiomycetous orders presented are polyphyletic. The orders Platygloeales and Sporidiales are highly polyphyletic. The Ustilaginales (-aceae) is polyphyletic due to the inclusion of *Microbotryum*. The orders Atractiellales, and Tremellales have been modified from the most recent treatments of these taxa.

The mini-essays called "longer entries" provide concise summaries of diverse current topics of interest to mycologists, but they should be separated from the terms and their definitions. Here the **Dictionary** has taken on the aspect of an encyclopedia. These longer entries may encourage editorial license in the standard entries.

In summary, the tremendous effort necessary for the compilation and indexing of new information in the 8th edition is to be commended. The logically indexed definitions of terms, with validating references to the primary literature, should be continued. Editorial opinion, however, should be confined to the preface and the foreword. Imposition of a **Dictionary**-endorsed *de novo* classification on the taxonomic entries masks the diversity of taxonomic opinion. The effort to expand the mission of this work with the incorporation of interpretative revisions of terms and concepts appearing for the first time in the **Dictionary** must be viewed with skepticism in preparation for the 9th edition. *Don R. Reynolds, Natural History Museum, 900 Exposition Boulevard, Los Angeles, CA 90007, and Eric Swann, Department of Plant Biolology, University of Minnesota, St. Paul, MN 55108-1095.*

***Polyporus* (Basidiomycotina) and Related Genera**, by Maria Nuñez and Leif Ryvarden, with drawings by Leif Ryvarden. 210 x 155 mm, 85 pp, 1995. Synopsis Fungorum vol. 10. Fungiflora A/S, P.O. Box 95, Blindern, N-0314, Oslo, Norway. Fax: 47-2285-6717. ISBN 82-90724-15-2. NOK 100.

This is a world-wide monograph on the genus *Polyporus*, type of the family Polyporaceae *sensu* Donk (Aphyllophorales, Basidiomycotina), and of its morphologically related genera *Echinochaete*, *Pseudofavolus*, and *Laccocephalum*. The book is divided in the following nine sections: Introduction (which presents a taxonomic and nomenclatural history of the genus *Polyporus*, its typification, and the species concept adopted by the authors), Taxonomic characters (a detailed explanation of the characters found in the genus together with a discussion on the relative taxonomic weight of each character), Ecology of the species and infrageneric groups, Genera related to *Polyporus*, Key to genera and species, Acknowledgments, Excluded species, References, and Index.

This manual sets the present knowledge on the treated genera and is a useful and indispensable guide to students of polypores. The taxa are presented alphabetically, their descriptions being complete and according to a standardized set of characters, including references to cultural studies. This is most useful to the reader because of the clarity of the presentation and the ease of comparison with other species. Drawings, however, are scanty, restricted to spores and to the setoid elements present in *Echinochaete*. One would appreciate having figures of the vegetative hyphae that, according to the reviewer's experience and the literature, present variation within the genus *Polyporus*.

This study is based mainly on morphological characters. In spite of the authors' claim that "the biological species concept has been the criterion used in this work," neither experimental data on mating tests, nuclear behavior of the mycelium, isoenzymological, nor DNA studies are presented. Nevertheless, other non-morphological key features of Aphyllophorales taxonomy, such as the type of rot produced by these organisms, have certainly been considered. Indeed, the restoration of the genus *Laccocephalum*, based on its association with a brown rot but long included as a synonym of *Polyporus*, a white rot genus, is one of the main achievements of the work.

Several species complexes have been treated as such, with no attempt to resolve them. Thus, they have been accepted in a very broad sense. This is especially so with *Polyporus tenuiculus* (=*Favolus brasiliensis*), which incorporates species with clamped and simple-septate generative hyphae, spores of various sizes, and glabrous to tomentose pilei. Synonymy has followed the previous work of Ryvarden on type studies in polypores, together with other authors' works. I have found several discrepancies regarding Spegazzini's species, some of which were accepted by Ryvarden in previous works, but have been changed without explanation in the present volume. Some species have not been treated at all, such as *Polyporus puttemansii*, an alleged synonym of *P. guianensis*. Some species are synonymized in a cryptic way; they are considered as such under the Remarks or under the Cultural characteristics comments of a species but are not distinctly cited in its synonymy (*e.g.*, *P. hypomelanus* under *P. gayanus*, and *P. lowei* under *P. admirabilis*).

Typographical errors are almost completely absent. Nevertheless, "mm" has been used instead of "µm" throughout the work. [This and other errors are corrected in an errata sheet. *D.S.H.*] In addition, Spanish characters are omitted. This is especially unfortunate because it affects the senior author's name, which is presented as "Nunez" instead of "Nuñez." This will almost certainly lead to incorrect referencing of this work in the literature.

Overall, this monograph sets the basis for a comprehensive knowledge of the treated genera all over the world. Discrepancies, such as the cases of recently described species that are synonymized in this book, will prompt students to clarify the taxonomic status in several complexes with tools other than strict morphological criteria. I congratulate the authors of this work and recommend it to specialists. *Mario Rajchenberg, Centro de Investigación y Extensión Forestal Andino Patagónico, Esquel, Chubut, Argentina.*

MYCOTAXON

Volume LX, p. 497 October-December 1996

NOTICE: Transfer of Professor E. J. H. Corner's Mycological Material

Professor E. J. H. Corner's mycological material, except for the types already in the holdings of the Cambridge University Herbarium, has been transferred to the Royal Botanic Garden, Edinburgh (E). It will be housed there along with Professor Corner's paintings, manuscripts and annotated publications; a small area of the new library extension has been dedicated to this unique collection of archival material.

As it will take some time to sort and catalogue the material it is impossible to send specimens out on loan. However anyone wishing to work through collections will be welcome in Edinburgh where either Evelyn Turnbull or Dr. Roy Watling, Royal Botanic Garden, Edinburgh EH3 5LR, can guide them through the maze of boxes and containers.

Author Index, Volume Sixty

Abdullah, Samir K., J. Guarro and M. J. Figueras New and Interesting *Helicoon* Species from Spain. 449-454
Abraham, T. K., K. B. Vrinda and C. K. Pradeep A New Species of *Hygrocybe* from India. 361-364
Ammirati, Joseph F., Jr. see Burdsall, Volk and Ammirati
Anderson, Freda, and Virginia Bianchinotti A New Species of *Bartalinia* Tassi (Deuteromycotina, Coelomycetes). 191-200
Arambarri, A. M. see Godeas and Arambarri
Baka, Zakaria A., and Halvor B. Gjærum Egyptian Uredinales. I. Rusts on Wild Plants from the Nile Delta. 291-303
Baral, Hans Otto *Hymenoscyphus seminis-alni*, a New Species of the *H. fructigenus* -Complex. 249-256
Barr, Margaret E. Planistromelaceae, a New Family in the Dothideales. 433-442
Baydar, Saffet see Sesli and Baydar
Bessette, Alan E. see Fatto and Bessette
Bianchinotti, Virginia see Anderson and Bianchinotti
Boisselier-Dubayle, M. C. see Perreau-Bertrand, Boisselier-Dubayle and Lambourdiere
Bolontrade, Marcela F. see Wright, Bolontrade and Fazio
Burdsall, Harold H., Jr., Thomas J. Volk and Joseph F. Ammirati, Jr. *Bridgeoporus*, a New Genus to Accommodate *Oxyporus nobilissimus* (Basidiomycotina, Polyporaceae). 387-395
Buyck, B. see Robert and Buyck
Cano, J. see Castañeda Ruíz, Guarro and Cano
Castañeda Ruíz, Rafael F., J. Guarro and J. Cano Notes on Conidial Fungi. X. A New Species of *Ceratosporella* and Some New Combinations. 275-281
_____**, D. E. Fabré, M. P. Parra, M. Pérez and J. Guarro** Some Airborne Conidial Fungi from Cuba. 283-290
_____ see Peláez and Castañeda Ruíz
Cázares, Efrén see Trappe, Jumpponen and Cázares
Chen, Kuei-Yu, and Zuei-Ching Chen A New Species of *Thermoascus* with a *Paecilomyces* Anamorph and Other Thermophilic *Thermoascus* Species from Taiwan. 225-240
_____ **and** _____ *Thielavia pingtungia* sp. nov. a Thermophilic Ascomycete from Taiwan. 241-247
Chen, Zuei-Ching see Chen and Chen
Claessen De Miranda, Jeanne see Lance Spain and Claessen De Miranda
Currah, R. S. see Tsuneda, Maekawa and Currah
De, A. B. *Royoporus* –A New Genus for *Favolus spathulatus*. 143-148
_____ see Roy and De
Descals, Enrique see Marvanová and Descals
Diederich, Paul see Etayo and Diederich
Estrada-Torres, A. see Rodríguez-Palma and Estrada-Torres
Etayo, Javier, and Paul Diederich Lichenicolous Fungi from the Western Pyrenees, France and Spain. II. More Deuteromycetes. 415-428
Fabré, D. E. see Castañeda Ruíz, Fabré, Parra, Pérez and Guarro
Fatto, Raymond M., and Alan E. Bessette A New Species of *Callistosporium*.. 125-128
Fazio, Alejandra T. see Wright, Bolontrade and Fazio
Figueras, Maria José see Abdullah, Guarro and Figueras
_____ see Mercado Sierra, Figueras, Mena Portales
Gjærum, Halvor B. see Baka and Gjærum

Godeas, A. M., and A. M. Arambarri *Helicoon septatissimum* sp. nov., a New Species from Tierra del Fuego. 481-484
Guarro, J. see Abdullah, Guarro and Figueras
_____ see Castañeda Ruíz, Guarro and Cano
_____ see Castañeda Ruíz, Fabré, Parra, Pérez and Guarro
Harvey, Alan E. see Larsen, Harvey, Powers and Jurgensen
Hibbett, D. S. Book Reviews 491-496
Hjortstam, Kurt, and Leif Ryvarden New and Interesting Wood-Inhabiting Fungi (Basidiomycotina–Aphyllophorales) from Ethiopia. 181-190
Jumpponen, Ari M. see Trappe, Jumpponen and Cázares
Jurgensen, Martin F. see Larsen, Harvey, Powers and Jurgensen
Koch, J., and K. R. L. Petersen A Check List of Higher Marine Fungi on Wood from Danish Coasts. 397-414
Lance Spain, Joyce, and Jeanne Claessen De Miranda *Scutellospora cerradensis:* An Ornamented Species in the Gagasporaceae (Glomales) from the Cerrado Region of Brazil. 129-136
_____ **and Jeanne Claessen De Miranda** *Glomus brasilianum:* An Ornamented Species in the Glomaceae. 137-142
Lambourdiere, J. see Perreau-Bertrand, Boisselier-Dubayle and Lambourdiere
Larsen, Michael J., Alan E. Harvey, Robert Powers and Martin F. Jurgensen A New Species of *Botryobasidium* (Corticiaceae, Aphyllophorales) Inhabiting the Interiors of Brown Rotted Logs of Ponderosa Pine. 429-432
Longcore, Joyce E. Chytridiomycete Taxonomy Since 1960. 149-174
Lunghini, D., F. Pinzari and L. Zucconi Studies on Mediterranean Hyphomycetes. III. *Quadracaeamediterranea* anam.-gen. and sp. nov. 103-110
Maekawa, N. see Tsuneda, Maekawa and Currah
Malcolm, W. M. see McCarthy and Malcolm
Manandhar, J. B., and T. W. Mew *Pinatubo oryzae* gen. et sp. nov. and its Identity During Routine Tests of Rice Seed. 201-212
Marvanová, Ludmila, and Enrique Descals Hyphomycetes from Streams: New Taxa and New Combination. 455-469
McCarthy, P. M., and W. M. Malcolm *Strigula occulta*, a New Saxicolous Lichen from New Zealand. 323-326
Mena Portales, Julio see Mercado Sierra, Figueras, Mena Portales
Mercado Sierra, Angel, Maria José Figueras, Julio Mena Portales A New Species of *Alysidiopsis* from Mexico. 443-448
Mew, T. W. see Manandhar and Mew
Mohammed, C. see Yuan, Mohammed and Wardlaw
Parra, M. P. see Castañeda Ruíz, Fabré, Parra, Pérez and Guarro
Parmalee, J. A. A Catalogue of Types (Uredinales) in the National Mycological Herbarium (DAOM) Ottawa, Canada. 1-77
Peláez, Fernando, and Rafael F. Castañeda Ruíz *Amoenodochium humicola* anam. gen. et sp. nov., a New Sporodochial Hyphomycete from Indian Soil. 257-262
Pérez, M. see Castañeda Ruíz, Fabré, Parra, Pérez and Guarro
Perreau-Bertrand, J., M. C. Boisselier-Dubayle and J. Lambourdiere *Mycena sororia* sp. nov., Close to *M. rosea* Gramberg (Basidiomycotina). 263-273
Petersen, K. R. L. see Koch and Petersen
Piccolo Grandi, Rosely Ana, and Derlene Silva Attili Hyphomycetes on *Alchornea triplinervia* (Spreng.)Müll. Arg. Leaf Litter from the Ecological Reserve Juréia-Itatins, State of São Paulo, Brazil. 373-386
Pinzari, F. see Lunghini, Pinzari and Zucconi
Powers, Robert see Larsen, Harvey, Powers and Jurgensen
Pradeep, C. K. see Abraham, Vrinda and Pradeep
Robert, V., and B. Buyck ALLRUS: A System for Standard Description, Identification and Classification of Russulaceae. 471-480
Roberts, Peter Heterobasidiomycetes from Majorca & Cabrera (Balearic Islands). 111-123

Rodríguez-Palma, M., and A. Estrada-Torres Some Stemonitales (Myxomycetes) from the State of Tlaxcala, Mexico. 79-102
Roy, Anjali, and A. B. De Taxonomy of *Fomitopsis rubidus* comb. nov. 317-321
Ryvarden, Leif see Hjortstam and Ryvarden
Sesli, Ertugrul, and Saffet Baydar A Preliminary Checklist of Agaricales in Turkey. 213-224
Silva Attili, Derlene see Piccolo Grandi and Silva Attili
Trappe, James E., Ari M. Jumpponen and Efrén Cázares NATS Truffle and Truffle-Like Fungi 5: *Tuber lyonii* (=*T. texense*), with a Key to the Spiny-Spored *Tuber* Species Groups. 365-372
Tsuneda, A., N. Maekawa and R. S. Currah A New Species of *Leptodontidium* from *Quercus acutissima*.. 485-490
Van der Gucht, Katleen *Xylaria* Species from Papua New Guinea: Cultural and Anamorphic Studies. 327-360
Volk, Thomas J. see Burdsall, Volk and Ammirati
Vrinda, K. B. see Abraham, Vrinda and Pradeep
Wardlaw, T. J. see Yuan, Mohammed and Wardlaw
Wright, Jorge E., Marcela F. Bolontrade and Alejandra T. Fazio The Genus *Pyrofomes* in Argentina and the Curltural Features of *P. lateritius* (Aphyllophorales). 305-315
Yuan, Z. Q., C. Mohammed and T. J. Wardlaw *Coccoidella exocarpi* sp. nov. on *Exocarpos* spp. from Australia. 175-180
Zucconi, L. see Lunghini, Pinzari and Zucconi

INDEX TO FUNGOUS AND LICHEN TAXA, VOLUME SIXTY

This index includes names of genera, infrageneric taxa, species, and infraspecific taxa.
New names are in **boldface,** and new names of suprageneric taxa,
which are also included, are in **BOLDFACE CAPITALS.**
The page on which new taxa are proposed is in **boldface.**

- Acarospora
  - fuscata 422
- Acaulospora
  - rehmii 141
- Acrodictys 275
  - furcata 278
- Actinocladium 275, 278
  - **longiramosum 278**
- Aecidium
  - ageratinae 5
  - berberidis 295
  - borrichiae 5
  - chuquiraguae 5
  - cressae 300
  - hornotinum 5
  - ilicina 8
  - ivae 5
  - leonense 5
  - ligustricola 6
  - millae 6
  - minimum 6
  - mundula 6
  - nectandrae 6
  - papudensis 6
  - pereskiae 6
  - plantaginis 294
  - poecilochromae 6
  - pulverulentum 6
  - pratae 6
  - punicium 6
  - sanguinolentum 297-298
  - tenebrosum 6
- Agaricus 264
  - arvensis 217
  - augustus 217
  - bernardii 217
  - bisporus 217
  - bitorquis 217
  - campestris 217
  - comtulus 217
  - cupreobrunneus 217
  - lanipes 217
  - meleagris 217
  - rodmani 217
  - semotus 217
  - silvicola 217
  - variecolar 217
  - xanthodermus 217
  - xerampelinus 217
- Agrocybe
  - aegerita 217
  - dura 217
  - pediades 218
  - semiorbicularis 217
- Allochytridium 151
  - expandens 151, 160
  - luteum 151
- Allodus
  - erigeniae 22
  - megalospora 43
- Allomyces 151
  - attomyces 151
  - catenoides 151
  - reticulatus 151
- Alternaria
  - alternata 203
- Alysidiopsis 443-445, 447
  - foliicola 444, 447
  - **lignicola** 443, **444**-447
  - pipsissewae 444, 447
  - yunnanensis 444, 447
- Alysidium 447
- Amanita 221
  - caesarea 217
  - citrina 217
  - codinae 217
  - excelsa 217
  - gemmata 217
  - junquillea 217
  - muscaria 217
  - ovoidea 217
  - pantherina 217
  - phalloides 217
  - rubescens 217
  - spissa 217
  - vaginata 217
    - var. alba 217
  - valens 217
  - verna 217
  - virosa 217
- **Amoenodochium 258**, 260
  - **humicola** 257, **258**-260, 262
- Amphicypellus 151, 155
  - elegans 151, 155
- Ampullifera
  - foliicola 416
- Amylocarpus
  - encephaloides 398, 402
- Anaeromyces 151, 172
  - elegans 151, 172
  - mucronatus 151
- Anguillospora 455-456
  - **fustiformis 455**-456, 458
- Aniptodera 400
- Anisostagma
  - rotundatum 398, 402
- Antrodia
  - juniperina 188

Aphanomyces 169
Appendichordella
  amicta 398, 402
Arachnophora 275, 278
  pulneyensis 278
Arenariomyces
  trifurcatus 398, 402
Armillaria 264
  bulbosa 218
  mellea 218
  tabescens 218
Arnaudovia 151
  hyponeustonica 151, 167
Arthrobotrys 201-202, 208-209
  amerospora 202
  anomala 201
  constringens 202
  dendroides 202
  ferox 202
  pauca 202
  stilbacea 201-202, 209
  superba 201
Arthuria
  catenulata 7
Arthuriomyces
  peckiana 7
Arxiella
  terrestris 288
Asperisporium 260, 285
  caricae 260, 262
Asteromyces
  cruciatus 398, 409
Asterophlyctis
  irregularis 151, 172
  sarcoptoides 151, 158
Athelopsis
  glaucina 182
  lembospora 185

Bachmanniomyces
  uncialicola 416
Baeodromus
  californicus 7
  eupatorii 7
  holwayi 7
Baeospora
  myriadophylla 127
Bartalinia 191-192, 197, 199
  bischofiae 197, 199
  cordylines 199
  lateripes 199
  mellea 191-**193**, 194, 196-199
  pistacina 199
  robillardoides 197-198
  tamarindi 197
Basidiodendron
  cinereum 116
  eyrei 117
  nodosum 111, 114-117
  rimulentum 111, 114, 116-117
Beauveria 209
  tenella 209
Biconiosporella
  corniculata 398-399, 402
Biflua
  physasca 398, 403
Blastocladia 169-171
  arborata 151
  caduca 151
  coronata 151
  cristata 151
  didyma 151
  elegans 151
  excelsa 151
  filamentosa 152
  fruticosa 152
  fusiformis 152
  globosa
    var. minutissima 152
  heterosporangia 152
  mammilata 152
  picaria 152
  pileota 152
  pusilla 152
  sessilis 152
  spiciformis 152
Blastocladiella 152
 Subg. Blastocladiella 152
 Subg. Cystocladiella 152, 157
 Subg. Eucladiella 152, 159
  anabaenae 152
  britannica 152
  colombiensis 152
  nova-zeylandiae 152
Blastocladiopsis
  elegans 152
Blyttiomyces
  aureus 152
  conicus 152
  exuviae 152
  gregarum 152
  harderi 152
  laevis 152
  lenis 152
  rhizophlyctidis 152
  spinosus 152, 169
  vaucheriae 153, 166
Bolbitius
  vitellinus 218
Boletus
  aereus 215
  aestivalis 215
  calopus 215
  chrysenteron 215
  edulis 215
  elegans 215
  erythropus 215
  luridus 215
  porphyrosporus 215
  queletii 215
  radicans 215
  regius 215
  retipes 215
  rufus 215

[Boletus] satanoides 215
  versicolor 215
  zelleri 215
Botryobasidium 429-431
  curtisii 431
  isabellinum 120
  medium 429, 431
  ponderosum 429, **430**-431
  subcoronatum 429, 431
Botryorhiza
  hippocrateae 7
Botryotrichum
  peruvianum 288
Bovicornua
  intricata 398, 403
Bridgeoporus 387-388, **390**
  nobilissimus **390**, 393-394
Bullaria
  carthami 293
Byssoloma 416
  leucoblepharum 416
  subdiscordans 416

Caecomyces 153
  communis 153
  equi 153
Callimastix
  cyclopis 153
  frontalis 153, 161
Calliospora
  diphysae 77
  holwayi 77
Callistosporium 125
  luteo-olivaceum 125, 127
  purpureomarginatum **125**-127
  rubescentifolia 125
Calocera
  cornea 122
Camarophyllus
  subradiatus 216
  virgineus 216
Canocybe
  coprophila 218
  lactea 218
  rickeniana 218
Canteria 153
  apophysata 153, 164
Capronia
  ciliomaris 398-399, 403, 414
Carbosphaerella
  leptosphariioides 398, 403
  pleosporoides 398, 403
Catenaria
  auxiliaris 153
  indica 153
  ramosa 153
  spinosa 153
  uncinata 153
  vermicola 153
  verrucosa 153
Catenochytridium
  carolineanum
    f. marinum 153
  hemicysti 153
  marinum 153
  oahuense 153
Catenophlyctis 153
  peltata 153
  variabilis 153, 159, 163, 166
    var. olduvaiensis 153
Caulochytrium 153
  gloeosporii 153
  protostelioides 154
Ceraceopsora
  elaegni 8
Ceratium
  hirundinella 170
Ceratobasidium 117
Ceratosebacina
  longispora 111, 117-118
Ceratosporella 275, 278-279
  basibicellularia 278-279
  basicontinua 278-279
  bicornis 278-279
  caliculata 278-279
  cheiroidea 278-279
  compacta 275, **276**-280
  deviata 278
  disticha 278-279
  fertilis 278-279
  flagellifera 278-279
  goidanichii 278
  lambdaseptata 278
  longiramosa 278
  novae-zelandiae 278-279
  ponapensis 278-279
  pulneyensis 278
  stipitata 278-279
Ceriosporopsis
  caduca 398-400, 403
  cambrensis 399
  halima 398, 403
  hamata 400
  longissima 399
  tubulifera 398, 403
Cerotelium
  holwayi 8
Chaetomastia
  typhicola 398-399, 404
Chaetopsina
  ramifera 379
Chaetosphaeria
  chaetosa 398, 404
Chalara
  aurea 373, 375-376
Chloridium
  virescens 373
    var. virescens 373, 375-376
Chroogomphus
  rutilus 215
Chrysocyclus
  mikaniae 8
Chrysomyxa
  ilicina 8

[Chrysomyxa] ledi
    var. glandulosi 8
    var. groenlandici 8
    var. vaccini 9
  monesis 9
  weirii 9
Chrysopsora
  gynoxidis 9
  mikaniae 8
Chytridium 154, 157, 169
  adpressum 154
  aggregatum 154, 157
  apophysatum 154
  brevipes 154, 157
  cejpii 154, 157
  chlorobotryis 154, 157
  citriforme 154, 157
  closterii 154
  codicola 154, 157
  coleochaetes 154, 169
  confervae 154-155
  corniculatum 154
  cresentum 154
  deltanum 154
  fusiforme 154
  gibbosum 154-155, 157
  hemicysta 153
  horariumforme 154
  hyperparasiticum 154
  inflatum 154, 157
  isthmiophilum 154, 157
  kolianum 154, 158
  lagenaria 154, 158
    var. japonense 158
  latipodium 154
  mallomonadis 155, 158
  marylandicum 155
  mucronatum 155, 158
  neopapillatum 155
  oedogonii 155, 158
  olla 154
  ottariense 155
  parasiticum 155-156
  pilosum 155
  proliferum 155
  reniforme 155
  schenkii 154-155, 158
    var. dumontii 155
  scherffelii 155, 158
  sexuale 155, 158
  sparrowii 155
  stellatum 155, 158
  suburceolatum 156
  telmatoskenae 155
  turbinatum 155, 158
Chytriomyces 151, 155
  angularis 155
  annulatus 155
  confervae 154-155
  cosmarii 155
  elegans 151, 155
  gilgaiensis 155
  heliozoicola 156
  hyalinus 156
    var. granulatus 156
  laevis 156
  macro-operculatus 156
    var. hirsutus 156
  mammilifer 156
  mortierellae 156
  multi-operculatus 156
  nagatoroensis 156
  poculatus 156
  reticulatus 156
  reticulosporus 156
  rhizidiomycetis 156
  rotoruaensis 156
  suburceolatus 156
  vallesiacus 156
  verrucosus 156
  willoughbyi 155-156
Ciboria
  alni 254
  seminicola 254
  uliginosa 254
Cirrenalia
  macrocephala 398-399, 409
Cladochytrium 162
  aureum 156
  granulatum 156, 162
  indicum 156
  novoguineense 156
  replicatum 156
  salsuginosum 156
Cladonia 416
  furcata 416
  parasitica 415, 424-425
  stellaris 423
  uncialis 416
Cladosporium 154, 377, 447
  cladosporioides 373, 376-377
Clitocybe
  alexandri 218
  cyathiformis 218
  dealbata 218
  ectypa 218
  familia 218
  fragrans 218
  geotropa 218
  gibba 218
  gigantea 218
  infundibuliformis 218
  inversa 218
  laccata 218
  lignatilis 218
  nebularis 218
  odora 218
  paropsis 218
  perilis 218
  radicellata 218
  rhizophora 218
  squamulosa 218
  tabascens 218

Clitopilus
    prunulus 216
Coccodothella 175
Coccoidea
    tsurudae 438
Coccoidella 175-176, 178-179, 438
    exocarpi 175-**176**, 179
    euglypta 179
    fici 179
    fusispora 179
    kawagoii 438
    perseae 178-179
    pulvinata 179
    quercifolia 179
    scutula 175, 178-179
    spinulosae 438
    stevensonia 179
    tsurudae 438
Codinaea
    simplex 379
Coelomomyces 150
Coelomycidium 156
Colacogloea
    peniophorae 114
Coleosporium
    adenocaulonis 9
    anceps 9
    begoniae 9
    cheoanum 10
    choerospondiatis 10
    crowellii 10
    elephantopodis 10
    paraphasatum 10
    rubiicola 10
    steviae 10
    verbesinae 10
    viguierae 10
Collaria 98, 100
    rubens 98
Colloderma 100
    roblustum 82
Collybia
    butyracea 218
    cessans 218
    colera
        var. rubescentifolia 125
    dryophila 218
    fusco-purpurea 219
    grammocephala 219
    longipes 219
    peronata 219
    tuberosa 219
Columnodontia 184
Comatricha 100
    aggregata 97
    elegans 97
    laxa 96
    lurida 96-97
    nigra 97
    rubens 79, 98
    subcaespitosa 98-100
    tenerrima 100
Coniothyrium
    ramalinae 418
Coprinus
    atramentarius 216
    comatus 216
    disseminatus 216
    galericuliformis 216
    micaceus 216
    niveus 216
    ovatus 216
    picaceus 216
    radiatus 216
Cornutispora
    lichenicola 418
Corollospora
    lacera 398-399, 404
    luteola 398-399, 404
    maritima 398, 404
Cortinarius
    auroturbinatus 220
    bulbosus 220
    bulliardii 220
    cotoneus 220
    glaucopus 220
    malachioides 220
    olivaceo-fuscus 220
    punctatus 220
    purpurascens 220
    subturbinatus 220
    subvalidus 220
Crepidotus
    cesatii 220
    mollis 220
    pubescens 220
    sphaerosporus 220
Crinigera
    maritima 399
Cronartium
    occidentale 10
    ribicola 11
Cryptophiale
    kakombensis 373, 376-377
    udagawae 373, 377-378
Cudoniella
    clavus 254
Cumminsiella
    wootoniana 11
Cumulospora
    marina 398-399, 409
Curvularia
    tuberculata 288-289
    verrucosa 288
Cylindrochytrium
    endobioticum 157
Cylindrocladium
    scoparium 373, 377-378
Cystoderma
    amianthinum 217

Dacrymyces 112
    enatus 122
    stillatus 122

Dactylaria
  kumamotoensis 288-289
Dactylomyces
  crustaceus 230
Dangeardia 157
  appendiculata 157, 172
  echinulata 157
  molesta 157, 159
  ovata 157
  sporapiculata 157
    var. minor 157
Dangeardiana 157
  apiculata 157-158
  eudorinae 157
  leptorrhiza 157, 172
  sporapiculata 157
Dextrinodontia
  molliuscula 182
Diacheopsis 83, 100-101
  effusa 83
  insessa 79, 83-84, 88
  nannengae 83
Diaporthe 435
Diatrype
  acervata 434
Dicheirinia
  superba 11
Dictyochaeta
  simplex 373, 379, 382
Dictyomorpha 157
  dioica 157, 167
    var. pythiensis 157
Dictyosporium
  pelagicum 398-399, 409
  toruloides 398-399, 410
Didymella
  myricariae 439
Didymopsora
  chuquiraguae 11
  triumfettae 11
Dietelia
  eupatorii 7
  holwayi 11
Digitatispora
  marina 398, 411
Diplochytridium 154, 157
  aggregatum 154, 157
  brevipes 154, 157
  cejpii 154, 157
  chlorobotryis 154, 157
  citriforme 154, 157
  codicola 154, 157
  gibbosum 154, 157
  inflatum 154, 157
  isthmiophilum 154, 157
  kolianum 154, 158
  lagenarium 154, 158
    var. japonense 158
  mallomonadis 155, 158
  mucronatum 155, 158
  oedogonii 155, 158
  schenkii 155, 158
  scherffelii 155, 158
  sexuale 155, 158
  stellatum 155, 158
  turbinatum 155, 158
Diplodia
  oraemaris 398, 410
Diplodina
  spinulosae 438
Diplomitoporus
  rimosus 181, 188
Diplophlyctis 158
  asteroidea 158
  butermerense 162
  buttermerensis 158, 162
  chitinophila 158
  complicata 158, 162
  intestina 172
  nephrochytrioides 158
  sarcoptoides 151, 158
  sexualis 158, 162
  versiformis 158
Dothidella 435
Dothistroma 437
  septospora 437
Dryosphaera
  navigans 398-399, 404
Dwalomyces
  taiwanensis 288

Edythea
  tenella 12
Eichleriella
  deglubens 123
Eiona
  tunicata 398, 404
Endochytrium
  cystarum 158
  multiguttulatum 158
Endophragmiella 103
  boewei 106-107
  verticillata 107
Endophyllum
  alaskanum 12
  holwayi 11
  lacus-regis 12
Endothia
  parryii 435
Enerthenema 100
  papillatum 83
Entoloma
  clypeatum 216
  lividum 216
Entophlyctis 158
  apiculata 157-158
  bulligera 158-159
    var. brevis 159
  caudiformis 159
  confervae-glomeratae 158-159
  crenata 159
  filamentosa 159
  helioformis 159
  lobata 159

[Entophlyctis] luteolus 159
  mammilliformis 159
  molesta 157, 159
  obscura 159
  reticulospora 159
  rhizina 159
  sphaerioides 159
  texana 159
  variabilis 153, 159, 166-167
  vaucheriae 159
  willoughbyi 159
Eriomycopsis 209-210
  minuta 209
Eruptio 433, **437**, 440
  acicola 433, **438**
  pini 433, **438**
Eupenicillium 476
Exidiopsis
  effusa 123

Favolus 145, 147
  brasiliensis 145, 147
  moluccensis 145, 147
  spathulatus 143, 145, 147
  tenuiculus 145, 147
Flammula
  hybrida 219
  liquiritiae 219
  penetrans 219
  sapinea 219
  spumosa 219
  velutipes 219
Flavoparmelia
  caperata 422-423, 426-427
Fomes 388-389
  fulvo-umbrinus 306, 314
  juniperinus 306
  lateritius 305, 307
  nobilissimus 390
  perlevis 311
Fomitopsis 320
  pinicola 320
  rubidus **317**, 319
Fusarium 209-210, 417
  peltigerae 416
Fusicladium 285
Gaertneriomyces 159
  semiglobiferus 159, 165-166
  tenuis 159
Galerina
  marginata 220
  unicolor 220
Gerlachia
  oryzae 209
Gloeosporium 153
Gloiothele 182
  lamellosa 182
Glomus 137, 140
  albidum 141
  brasilianum 137-138, **139**-141
  callosum 141
  clarum 141
  convolutum 137
  leptotichum 141
  maculosum 141
  manihotis 137
  occultum 137
  pallidum 141
  scintillans 141
Gonapodya
  polymorpha 170-171
Gonopodya 159
  terrestris 159
Groenhiella
  bivestia 398, 404
Gymnoconia 7
  peckiana 7
Gymnosporangium
  asiaticum 13
  bermudianum 12
  betheli 12
  connersii 12
  davisii 12
  durum 13
  ellisii 13
  fraternum 13
  gaeumanii 13
    ssp. albertensis 13
  haraeanum 13
  harknessianium 13
  nelsonii 13
  nootkatense 13
Gyoerffyella 463

Hainesia 418
  lythri 418
  pertusariae 415, **417**
Haligena
  elaterophora 398, 405
  salina 398-399, 405
Halosarpheia 400
  retorquens 400
  trullifera 398, 405
  viscosa 398, 400, 405
Halosphaeria
  appendiculata 398-400, 405
Halosphaeriopsis
  mediosetigera 398, 405
Hamaspora
  longissima 14
  ozeenis 14
Hamatocanthoscypha 255
Hapalopera 159
  achnanthis 160, 168
  difficilis 160, 169
  fragilariae 160, 170
  melosirae 160, 170
  piriformis 160, 170
Haplographium
  heliocephalum 379
Haplotrichum 429-431
  curtisii 431
Harpochytrium 150, 160
  adpressum 160

[Harpochytrium] apiculatum 160
    botryococci 160
    hedenii 160
    hyalothecae 160
    intermedium 160
    monae 160
    natrophilum 160
    ornithocephalum 160
    tenuissimum 160
    viride 160
Hebeloma
    leucosarx 220
    populinum 220
    sinapizans 220
Helicodendron
    japonicum 451
Helicogloea
    lagerheimii 123
Helicoon 449, 451, 481, 483-484
    auratum 484
    chlamydosporum 451, 454, 484
    ellipticum 484
    farinosum 451, 484
    fuscosporum 449, 451, 453-454, 484
    macrosporum 451
    microsporum 449, **450**-452
    peruamazonense 451
    pluriseptatum 484
    richonis 483-484
    septatissimum **481**-484
    sessile 451, 484
Helotium
    nyssicola 254-255
Hemileia
    oxyanthi 14
Heterobasidion
    annosum 430
Hobsonia
    christiansenii 421-422
Hohenbuehelia
    atrocoerulea 219
    rickenii 219
Hyalopsora
    adianti-capilli-vernis 14
    diplazii 14
    polypodii 14
Hyaloscypha 255
Hygrocybe 361, 364
  Sect. Coccineae 364
    conica 216
    langei 216
    nigrescens 216
    parvispora **361**, 363
    subglobispora 216
Hygrophorus
    calophyllus 216
    chrysodon 216
    croceus 217
    eburneus 217
    fuscoalbus 217
    pudorinus 217
    russula 217
Hymenoscyphus 249-250, 255
    calyculus 255
    caudatus 255
    fructigenus 249, 253-254, 256
      var. aesculicarpa 254
      var. carpini 253-254
      var. coryli 254
    imberbis 455-456
    malawiensis 456, 458
    rokebyensis 254
    scutula 255
    seminis-alni 249-**250**, 253-256
Hyphoderma
    argillaceum 113-114
    praetermissum 114
Hyphodontia
    spathulata 182
Hypholoma
    fasciculare 218
Hypocrea
    agaves 435
Hypogymnia
    subphysodes
      var. austerodioides 175
Hypotrachyna
    revoluta 422-423, 426-427

Idriella
    falcata 373, 378-379, 383
Illosporium 422
    aurantiacum 421
    corallinum 420, 422
    roseum 421
Ingoldia 463
Inocybe
    fastigiata 220
    fibrosa
      var. trivialis 220
    geophylla
      var. lilacina 220
    gymnocarpa 220
    patouillardii 220
    perbrevis 220
    subrubens 220
    xanthodermus 221
Itersonilia
    perplexante 172

Karlingia 151, 160
    aurantiaca 160
    exo-operculata 160
    expandens 151, 160
    granulata 160
    lacustris 160
    lobata
      var. microspora 161
    polonica 161
    rosea 156, 169
    spinosa 161
Karlingiomyces 160-161
    granulatus 160
    laevis 161

Kavinia
  alboviridis 183
Kellermania
  anomala 434
  uniseptata 434
  yuccifoliorum 434
  yuccigena 434
Kionochaeta
  ramifera 373, 378-379, 383
Kirschsteiniothelia
  maritima 398, 405
Kochiomyces 161
  dichotomus 161, 165
Kohlmeyeriella
  tubulata 398-399, 405
Kuehneola
  ramacharii 15
Kuehneromyces
  mutabilis 218

Laccaria
  amethystina 219
  laccata 219
Lacrymaria
  lacrymabunda 216
   var. velutina 216
Lactarius 471
Lacustromyces 161
  hiemalis 161
Lamproderma 100
  columbinum 95
  echinulatum 95
  nigrisplendidum 95
  scintillans 96
Lasallia
  papulosa 423
Laschia
  spathulata 143, 145, 147
Lauriomyces
  heliocephala 373, 379-380, 383-384
Lautisporopsis
  circumvestita 398, 406, 414
Lecanosticta 437
  acicola 437
Leccinum
  carpini 215
  corsicum 215
  insigne 215
  oxydabile 215
  quercinum 215
  scabrum 215
  subleucophaeum 215
  versipelle 215
Lentescospora
  submarina 400
Lentinula
  edodes 486, 488
Lepiota
  acutesquamasa 217
  alba 217
  badhamii 217
  brunneo-incarnata 217
  cristata 217
  cygnea 217
  holosericea 217
  jubilaei 217
  litoralis 217
  naucina 217
  rhodorrhiza 217
Lepista
  luscina 219
  nuda 219
  saeva 219
  sordida 219
Leptodontidium 485-486
  elatius 485
  irregulare 488
  orchidicola 485-486, 488, 490
  quercuum 485-**486**, 488, 490
Leptogium 325
Leptosphaeria
  oraemaris 398, 406
  pelagica 398-399, 406
Leucoagaricus
  leucothites 217
Leucopaxillus
  amarus 219
  cerealis 219
  gentianeus 219
Lichenoconium
  cargillianum 418
Lichenopuccinia
  poeltii 418
Limacospora
  sundica 398, 406
Lindra
  inflata 398, 406
Litschauerella
  abietis 183
  clematitis 183
  gladiola 183
Loratospora 433, 437, 440
  aestuarii 437
Loweporus 306, 314
Lulworthia
  fucicola 398-399, 406
  lignoarenaria 398, 406

Macrochytrium
  botrydiella 161
  botrydioides
   var. minutum 161
Macrolepiota
  excoriata 217
  mastoidea 217
  permixta 217
  procera 217
Macrophomina
  phaseolina 419
  pseudeverniae 415, **419**-420
Mainsia
  clara 15
  holwayii 15
  tenella 15

Marasmius
  androsaceus 219
  calopus 219
  caryophylleus 219
  exocarpi 175
  oreades 219
  perforans 219
  ramealis 219
  resinosus 219
  rotula 219
  splachnoides 219
Marchandiomyces 415, 420, 423, 427
  aurantiacus 415, **421**, 423
  corallinus 415, 420-423
Marinosphaera
  mangrovei 398-400, 406, 413-414
Marinospora
  calyptrata 398-399, 407
  longissima 398-400, 407
Marisolaris
  ansata 398, 407
Massarina
  thalassiae 398-400, 407, 414
Melampsora 291-292
  aleuritidis 15
  epitea
    f. sp. tsugae 15
  euphorbiae 291-292
  euphorbiae-gerardiana 291
  helioscopiae 291
  lini 15
  piscariae 15
Melampsorella
  kriegeriana 16
Melanelia 422-423
  exasperata 422-423
  glabratula 422-423
  panniformis 422-423
  substygia 427
  tominii 427
Melanoleuca
  cinerascens 219
  cognata 219
Meliola
  exocarpi 175
Melzericium
  udicola 183
Menegazzia
  confusa 175
Metacapnodium
  juniperi 439
Microallomyces 161
  dendroideus 161
Microcyclus 175-176, 178, 433, 438, 440
  angolensis 438
  kawagoeii 433, 436, **438**
  porlieriae 438
  tinctorius 178, 438
Microdochium
  falcatum 379
Micromphale
  brassicolens 219
Micromyces
  furcata 161
  grandis 161
Micronegeria
  alba 16
Milesia
  asplenii-incisa 16
  vogesiaca 17
Milesina
  asplenii-incisa 16
  blechnicola 16
  faulliana 16
  feurichii 16
  jezoensis 16
  kameiana 16
  kriegeriana 16
  laeviuscula 17
  tobinagai 17
  vogesiaca 17
Milospium 425
  graphideorum 425
  lacoizquetae 415, **424**-425
Mimema
  holwayii 66
Mitochytridium
  regale 161
Monoblepharella 161
Monoblepharis
  micrandra 161
Monodictys
  pelagica 398-399, 410
Monophagus 161
  blackmanii 161
  bruhlii 161
Morchella 263
Mortierella 156
Muellerella 439
  dalbergiae 439
Mycena 263-268
 Sect. Calodontes 263-264, 267
 Subsect. Purae 264, 268, 271
  alcalina 219
  atroalba 219
  auroricolor 271
  corticola 219
  epipterygia 219
  fibula 219
  filopes 219
  galericulata 219
  inclinata 219
  integrella 219
  niveipes 219
  parabolica 219
  plicosa 219
  polygramma
    f. pumila 219
  pseudocorticola 219
  pura 219, 263-268, 271
    var. rosea 264
    f. pura 271
    f. roseoviolacea 271
  rosea 263-268, 270-271

[Mycena] sanguinolenta 219
  sororia 263-**268**, 269, 271
  speirea 219
  strobilicola 219
  stylobates 219
  subincarnata 219
  tintinnabulum 219
  vulgaris 219
Mycoacia 181, 184
  aurea 185
  austro-occidentalis 185
  brunneofusca 181, **183**, 185
  columellifera 184
  fuscoatra 183-184
  lutea 184
  nothofagi 184
  subceracea 184
  subconspersa 185
  subfascicularia 185
  uda 184
Mycoleptodiscus
  brasiliensis 373, 380-381
Mycosisymbrium
  cirrhosum 262
Mycosphaerella 435, 437, 440
  apophlaeae 440
  ascophylli 440
  dearnessii 437
  deightonii 435
  gibsonii 437
  myricariae 439
  pini 437-438
Mycosphaerellopsis 433, 439-440
  myricariae 436, 439
Myxarium
  nucleatum 112, 123

Naematoloma
  sublateritium 218
Nais
  inornata 398, 407
Naucoria
  abstrusa 221
Nautosphaeria
  cristaminuta 398, 407, 414
Neocallimastix 161
  frontalis 153, 161-162
  hurleyensis 162
  joyonii 162, 164
  patriciarum 161-162
  variabilis 161-162
Nephrochytrium
  bipes 162
  buttermerense 158, 162
  complicatum 158, 162
  sexuale 158, 162
Nereiospora
  comata 398-399, 407
  cristata 398, 407
Nia
  vibrissa 398, 411
Nothoravenelia
  japonica 17
Nowakowskiella 162
  crassa 155, 162
  delica 162
  elegans 162
  endogena 162
  granulata 156, 162
  keratinophila 162
  methistemichroma 162
  moubasherana 162
  multispora 162
  pitcairnensis 162
  profusa 162, 171
    f. constricta 162
  sculptura 162
Nyssopsora
  koelreuteriae 17

Obelidium
  megarhizum 162
Occultifur 112
Ocostaspora
  apilongissima 398, 400, 408
Oedogoniomyces 163
Oidium 431
  curtisii 431
Oligoporus 389
Oligostroma
  acicola 437-438
Olpidium 163, 166
  appendiculatum 163
  bornovanus 163, 167
  brassicae 163, 167
  cucurbitacearum 163, 167
  entophlyctoides 163
  fulgens 163
  incognitum 163
  indicum 163
  indum 163
  longum 163
  nematodae 163
  poreferum 163
  pseudoeuglenae 163
  radicale 163, 167
  rostriferum
    var. indica 163
  sparrowii 163
  synchytrii 163
  vermicola 163
  virulentus 163, 167
  wildemani 163, 167
  zopfianus 163, 167
Omphalina
  abiegna 219
  gracillima 219
  hepatica 219
  hydrogramma 220
  leucophylla 220
  olearius 220
  velutina 220
Omphalotus
  olearius 215

Ondiniella
  torquata 398-399, 408, 414
Oogaster 370
Orbimyces
  spectabilis 398, 410
Orpinomyces 164
  bovis 164
  intercalaris 164
  joyonii 162, 164
Oudemansiella
  mucida 220
  radicata 220
Oxyporus 387-389
  nobilissimus 387-390, 394
  populinus 389

Pachycladina
  mutabilis 456
Paecilomyces 225-226, 230, 232
  crustaceus 235
  taitungiacus 226-227
Panaeolus
  acuminatus 216
  campanulatus 216
  fimicola 216
  foenisecii 216
  retirugis 216
Panellus
  mitis 220
  stypticus 220
Pannaria
  inmixta 325
Parmelia 415, 417, 419, 422, 426
  hygrophila 419
  omphalodes 422-423
  perforata 418
  saxatilis 418-419, 422-423, 426
  sulcata 418-419, 422-423, 426
Parmeliella
  testacea 416
Parmelina
  quercina 422-423
Parmeliopsis
  ambigua 422-423
Parmotrema
  crinitum 422-423
Passalora 285
Paxillus
  atrotomentosus 215
  involutus 215
  panuoides 215
  rhodaxanthus 215
Pazschkeella
  brasiliensis 438
Peltigera
  rufescens 416
Penicillium 476
Peniophora 187
  quercina 187
Penzigia
  frustulosa 338
Perenniporia 306, 314
  gomezii 306, 314
Peridermium
  yamabense 17
Pertusaria 415, 417-418, 427
  albescens 427
  multipuncta 422-423, 427
  ophthalmiza 427
  pertusa 422-423, 427
  pustulata 422-423
Pestalozzina
  cordylines 199
Phaeoisaria
  clematidis 373, 380-381, 383
  infrafertilis 373, 380-381, 383
Phaeophyscia 421
  orbicularis 421
Phakopsora
  cheoana 18
  ehretiae 18
  meliosmae 19
  psoraleae 18
  tecta 18
Phanerochaete 184-185
  rosea 185
Phellinus
  demidoffii 306
Phlebia 184
Phlebiella
  ardosiaca 185
Phlegmacium
  amoenolens 221
  variecolar 221
Phlyctidium 164, 168
  anatropum 164, 168
  apophysatum 153, 164
  brevipes
    var. marinum 164, 169
  bumilleriae 164, 169
  globosum 164, 171
  keratinophilum 164, 169
    var. savulescui 164
  marinum 164, 170
  mycetophagum 164, 170
  olla 164, 170
  scenedesmi 164, 171
  spinulosum 164, 171
  tenue 164, 171
  tubulatum 164
Phlyctis 417
Phlyctochytrium 173
  acuminatum 164, 173
  aestuarii 164, 168
  africanum 164, 173
  apophysatum 164
  arcticum 164, 173
  aureliae 165-166
  biporosum 169
  californicum 159, 165
  chandleri 165
  circulidentatum 165
  cystoferum 165, 167
  dichotomum 161, 165

[Phlyctochytrium] dissolutum 165
  furcatum 165
  hirsutum 165
  incrustans 165
  indicum 165
  irregulare 165
  irregularis 165
  kniepii 165, 173
  lackeyi 165
  macrosporum 165
  mangrovii 165
  marilandicum 165
  megastomum 165
  mucosum 165
  multidentatum 165
  neuhausiae 165
  palustre 165, 173
  parasitans 165
  peruvianum 165, 173
  planicorne 166, 169
  plurigibbosum 166, 173
  powhatanense 166
  punctatum 166, 173
  recurvastomum 166
  reinboldtae 166
  semiglobiferum 159, 166
  spinosum 166
  unispinum 167
  variable 165-166
  vaucheriae 153, 166
  verruculosum 166, 173
Phlyctorhiza
  peltata 153
  variabilis 153, 159, 166
Pholiota
  adiposa 218
  astragalina 218
  aurivella 218
  caperate 218
  destruens 218
  flammans 218
  radicosa 218
  spectabilis 218
  squarrosa 218
  tuberculosa 218
Phragmidium
  andersoni 18
  boreale 19
  fusiforme
    var. novi-boreale 18
  guatemalense 18
  itoanum 18
  ivesiae
    ssp. wyomingense 19
  longissima 14
Phragmopyxis
  acuminata 19
Physalidiopsis 107
Physcia 421-422
  adscendens 421-422
  aipolia 422-423
  caesia 421-422
  semipinnata 421-422
  stellaris 421
  tenella 421
Physisporinus 389
  rivulosus 181, 188
Physoderma 149-150
Physopella
  meliosmae 19
Pileolaria
  clemensiae 19
  pistaciae 19
Pinatubo 201-**203**, 204, 209
  oryzae 201-**203**, 204-206, 208-210
Piptarthron
  crassisporum 437
  pluriloculare 435
  uniloculare 437
Piromonas
  communis 166
Piromyces 166
  communis 166
  dumbonicus 166
  mae 166
  minutus 166
  rhizinflatus 166
  spiralis 166
Planistroma 433, 435, 440
  nolinae 437
  obtusilunatum 435
  yuccigenum 435
Planistromella 433-435, 440
  acervata 433-**434**, 436
  parryi 433, **435**-436
  torsifoliorum 434
  uniseptata 434
  yuccifoliorum 434
  yuccigena 433-**434**
PLANISTROMELLACEAE **433**, 436, 438, 440
Platismatia
  glauca 418
Pleotrachelus 163, 166
  askaulos 166
  bornovanus 163, 167
  brassicae 163, 167
  fulgens 163
  virulentus 163, 167
  wildemani 163, 167
  zopfianus 163, 167
Pleuropedium 455, 458
  multiseptatum 455, **458**, 460, 462, 467
  tricladioides 458, 460, 463-464, 466-467
Pleurotus 264
  cornucopiae 215
  dryinus 215
  eryngii 215
  ilgazicus 215
  nemecii 215
  ostreatus 215
    var. salignus 216
  pubescens 216

[Pleurotus] pulmonarius 216
  serotinus
    var. flaccidus 216
  ulmarius 216
Plowrightia 435
  agaves 435
  circumscissa 435
  williamsoniana 435
Plurisperma
  dalbergiae 439
Pluteus
  atricapillus 216
  cervinus 216
  minutissimus 216
  petasatus 216
  salicinus 216
  tomentosulus 216
Podochytrium
  chitinophilum 167
  dentatum 167
  ellerbeckense 167
Polypaecilum 230
Polyphagus 151
  asymmetricus 167
  elegans 167
  hyponeustonica 151, 167
  serpentinus 167
  starrii 167
Polyphlyctis 167
  cystofera 165, 167
  unispina 167
Polyporus 145, 147, 264, 320
  connatus 389
  demidoffii 305
  moluccensis 145, 147
  populinus 389
  rubidus 317, 320
  spathulatus 147
Polystomella
  kawagoii 438
Polythrincium 260
  trifolii 260, 262
Porina 325
  guentheri 325
  leptalea 325
  partita 325
Postia 389-390
Powellomyces 158, 167
  hirtus 167
  variabilis 159, 167
Pringsheimiella 157
  dioica 157, 167
Prospodium
  amphilophii 19
  anomalum 20
  arrabidaeae 20
  cremastrum 20
  cyathiforme 20
  depallens 20, 41
  holwayi 20
  impolitum 20
  lundiae 20
  palmatum 20
  permagnum 20
  reticulatum 20
  stizophyllii 20
  tecomicola 21
  transformans 41
Psalliota
  edulis
    var. valida 217
  perrara 217
Psathyrella
  candolleana 216
  fatua 216
  gracilis 216
  melanthina 216
  obtusata 216
  prona 216
  spadiceogrisea 216
Pseudevernia
  furfuracea 415, 419
Pseudopileum 167
  unum 167
Pseudosphaerella 439
Psilocybe
  pratensis 218
Puccinia 3, 291
  abramsii 29
  abrupta 29
    var. partheniicola 30
  absicca 29
  acarnae 25
  achilleae 23
  actinostemonis 45
  additicia 30
  aegopogonis 3, 50
  aemulans 30, 32
  aenigmatica 47
  affinis 30
    var. triporosa 30
  agnita 55
  agnitionalis 39
  agoseridis 27
  albicera 47
  albigensis 295
  albula 23
  albulensis
    ssp. cascadensis 59
  alia 23
  allandabilis 39
  alnetorum 297
  altissimorum 25
  amphigena 50
  amphilophii 19
  amphispilusa 54
  amplifica 47
  anguriae 43
  anisicanthi 21
  antioquiensis 43
  arabicola 3, 41
  arisanensis 77
  aristidae
    var. chaetaiae 50

[Puccinia] asiatica 56
    asprellae-japonicae 50
    aulica 61
    austroberingiana
        ssp. austroberingiana 56
        ssp. saxifragarum 57
    axiniphylii 30
    baccharidis-spartea 23
    baeumleriana 23
    balsamorhizae 30
    basiporula 28
    batesiana 30
    benokiyamensis 54
    berberis-trifoliae 40
    bessei 49
    blutanensis 59
    boliviana 30
    brachycomes 23
    brachytela 31
    burnettii 50
    butleri 27
    caborcensis 31
    calanticariae 31
    calcitrapae
        var. centaureae 293
    caleae 31
        var. cuernavacae 31
    californicae 25
    calliquensis 46
    calvatica 47
    canadensis 62
    cancellata 292
    caricis-japonicae 43
    caricis-shepherdiae 43
    carthami 293
    cenchri
        var. africana 293
    centaureae 26
        var. diffusa 26
    cera 48
    chelonis 59
    chisosensis 50
    chloracae 31
    cinnamomicola 48
    claytoniicola 55
    cleomis 42
    clintonii
        var. albae 59
        var. bracteosa 59
        var. clintonii 59
        var. groenlandicae 59
        var. ornithorhyncae 59
        var. racemosa 59
        var. sylvaticae 60
    coccocypseli 56
    codyi 41
    cognata
        var. cognata 31
        var. echinulata 31
        var. fraseri 31
    compositarum 25
    concumulata 56
    confraga 60
    congdonii 43
    conjuncta 62
    connersii 51
    consueta 24
    consulta 24
    conturbata 47
    coronospora 48
    corylopsidis 46
    cressae 300
    cruciferarum
        ssp. borealis 41
        ssp. nearctica 42
        ssp. wyomingensis 42
    cryptandri
        var. luxurians 50
    cupheae 49
    cyani 26
        var. sublevis 26
    cymbopogonis 50
    cymopteri 22
        ssp. oregonensis 22
    cynodontis 291, 293-294
    cyperi 44
    cyperi-tegetiformis 291, 293
    cyrnaea 292
    dasypyri 298
    decpecanea 39
    defecta 38
    depallens 20, 41
    desantherae 60
    desmanthodii 32
    detonsa 42
    dianthi-japonica 42
    dichelostemmae 21
    diplachnicola 51
    discors 22
    discreta 39
    dispersa 298
    distenta 46
    distinguenda 42
    distorta 47
    douglasii
        var. douglasii 53
        var. hoodii 53
    drabicola 42
    effusa 62
    egmontensis 38
    elaeagni 45
    electrae 30
        var. depressiporosa 32
        var. electrae 32
        var. robusta 32
    ellisiana 50
    enceliae 30
        var. aemulans 32-33
        var. enceliae 32, 37
    erigeniae 22
    eriophorii
        var. apargidii 44
    eriophyllii 29
    eriostemonis 56

[Puccinia] espinosarum 28
  excursionis 24
  eximia 56
  exitiosa 41
  expetiva 24
  fausta 39
  ferox 32
  festata 45
  fidulis 47
  fimbristylidis 44
  fischeri 57
  fragilis
    var. hoodii 53
    var. fragilis 53
  fragosoana 291, 293, 295
  flavo-virens 44
  franseriae 32
  fraseri 27
  fumosa 54
  fundata 39
  fuscata 47
  gahniae 44
  ghiesbrechtii 33
  giliae 54
  giliicola 54
  gilliesiana 33
  gilva 41
  glacieri 62
  globulifera 33
  glumarum 300
  grahami 22
  graminis
    ssp. graminicola 295
    ssp. graminis 295
  grenfelliana 22
  grumosa 49
  guardiolae 33
  guatemalenses 33
  gulosa 54
  gymnandrae
    ssp. alascensis 60
    ssp. camschatcensis 60
    ssp. gymnandrae 60
    ssp. yunnansis 60
  gymnolomiae 32-33
  gypsophila-repentis 42
  haleniae 45
  harae 57
  harknessii
    var. harknessi 27
    var. stephanomeriae 27
  hedysari-paniculati 72
  helianthellae 33
  helianthi 33
  helicalis 60
  heterothalami 24
  heucherae
    var. asiatica 56
    var. austroberingiana 56
    var. cordillerana 57
    var. diffusistriata 57
    var. japonica 57
    var. meridionalis 57
    var. minor 57
    var. saxifragae-micranthae 57
  hieracii 27
  holwayula 33
  huteri 58
  hyalina 44
  idonea 39
  illatabilis 39
  impedita 47
  imperatae 291, 295
  impetrabilis 39
  impolita 24
  improcera 24
  improvisia 40
  inaequata 40
  inanipes 28
  inaudita 33
  inclusa
    var. boreohesperia 26
    var. brevifolia 26
    var. flodmannii 26
    var. mexicana 26
  incomposita 24
  indagata 24
  inopina 24
  inrecta 49
  insignis 43
  insperata 27
  interjecta 24
  intermixta 34
  invelata 34
  iostephanes 34
  irregularis 34
  irrequisita 26
  isiacae 291, 296
  juncellii 44
  karelica
    ssp. laurentia 44
  kuhniae
    var. robusta 28
  kukkonensis 49
  kuntzii 40
  kwangsiana 26
  kweichowana 55
  lagenophorae 291, 296
  laschii
    var. fennica 26
    var. palustris 26
    var. pannonici 27
    var. xerophila 27
  lauricola 48
  lepturi 50
  lezpedezae-procumbentis 72
  lisianthi 46
  loranthicola 49
  machii 48
  magnusiana 297
  mahoniae 40
  majuscula 38
  mandevilleae 23
  mariae 62

[Puccinia] marie-wilsonii
    var. montiae 55
  massalis 34
  megalospora 43
  melampodii 25, 34-35, 37
  menthae 297
  mikanae 28
  minussensis 28
  mirifica 34
  moliniicola 51
  morigera 51
  mundula 22
  nanomitra 34
  neocoronata 51
  nesodes 60
  noccae 34
  nociva 44
  nocticolor 43
  notha 40
  nothoscordi 21
  notopterae 35
  nuda 35
  oahuensis 51
  obeisiseptata 29
  obesispora 21
  oblata 35
  oblongula 44
  obvoluta 44
  okudairai 48
  opaca 35
  orbicula 28
  ordinata 35
  osoyoosenis 44
  otopappicola 35
  otoppi 35
  oxypetali 23
  pachyspora 29
  paederotae 60
  pallor 22
  paradoxica 51
  parkerae 46
  paroselae 45
  parthenices 35
  parthenii 30, 35
  pazschkie
    var. ferruginea 58
    var. huteri 58
    var. oppositifolia 58
  pedatissima 60
  perfuncta 47
  perincerta 24
  permagna 62
  permagnum 20
  perscita 47
  perspicabilis 24
  pertrita 40
  pervenusta 24
  pestibilis 40
  petalstemonis 77
  picturata 49
  pimpinellae
    ssp. carlottae 22
  pinaropappi 28
  pinguis 40
  piqueriae 29
  plagianthi 49
  plumbaria 54
  poae-nemoralis
    ssp. hyparctica 51
  poecilochromae 61
  polemonii 54
  polliniae-quadrinervis 51
  polygoni-amphibii
    var. polygoni-amphibii 297
  polypogonis 291, 298
  polymniae 35
  poromera 22
  porphyretica 47
  porphyrogenita 43
  praealta 40
  praeculta 25
  praegracilis
    var. cabotiana 51
    var. connersii 51
    var. praegracilis 51
  praemorsa 29
  praetermissa 36
  praevara 21
  proba 36
  procerula 38
  proluviosa 38
  punctoidea 36
  puritanica 44
  rangiferina 52
  rata 40
  recondita 298
  repentina 22
  retecta 55
  ribesii-japonica 46
  rimosa 292
  ripulae 25
  rudbeckiae 36
  ruderaria 25
  rufescens
    var. densiflora 61
    var. rufescens 61
  russa
    var. leptotricha 25
  sakamotoi 46
  salebrata 25
  sana 47
  saxifragae
    var. heucherarum 58
    var. holochloe 58
    var. longior 58
    var. mitellae 58
  saxifragae-gei 58
  saxifragae-micranthae 57
  schedonnardi 52
  schileana 36
  schistocarphae 38
  scillae-rubrae 52
  scimitriformis 48
  scirpi 299

[Puccinia] scleropogonis 52
  semota 36
  senecioicola 39
  senecionis 39
  seposita 48
  serratulae 27
  setariae 52
  shiraiana 3, 21
  silphii 36
  solidpes 29
  sonorae 36
  sonorica
    var. sonorica 52
  sparganioides 52
  sphacelicola 48
  sphenica 25
  splendens 36
  stapfiolae 299
  steiractiniae 36
  stephanomeria 27
  striiformis 291
    var. dactylidis 300
    var. striiformis 299
  subaquila 36
  subglobosa 37
  subita 38
  substerilis
    var. oryzopsidis 52
    var. substerillis 52
  substriata 52
  suksdorfii 28
  takakumensis 48
  tanaceti 32
  tecomicola 21
  terrieriana 296
  tetramerii 21
  thelypodii 42
  thuemenia 61
  tithoniae 37
  tosta luxurians 50
  tottoriensis 58
  tournefortiae 41
  treleasiana 55
  triumfettae 61
  trixitis 38
  troximontis 28
  turgidipes 37
  tuyutensis 300
  unica 52
  urbanis 55
  vaga 37
  vanillosmopsidis 40
  velata 45
  veniabilis 40
  verbesinae 37
  vergrandis 45
  veronicae-longifoliae 61
  veronicarum 60
  vexans 53
  vilfae
    var. mexicana 53
    var. vilfae 53
  vinulla 62
  violae
    ssp. americana 62
  virgata 53
  wedeliae 37
  wedeliicola 37
  wulfeniae
    ssp. saximontana 61
  xanthii 37
  ximenesiae 37
  yosemitana 54
  zaluzeniae 38
  zexmeniae 35, 38
Pucciniastrum
  fagi 63
  hikosanense 63
  hydrangeae-petiolaridis 63
  kusanoi 63
  miyabeanum 63
  pseudo-cerasi 63
  styracinum 64
  yoshinagai 64
Pucciniosira
  holwayi 64
Punctelia
  subrudecta 426-427
Pycnoporellus 389
Pyrenochaeta
  xanthoriae 425
Pyrofomes 305-306, 314
  albomarginatus 306-307, 314
  aurantiacus 306, 314
  demidoffii 188, 306, 314
  fulvo-umbrinus 314
  lateritius 305-310, 313-314
  perlevis 305-307, 311-314
  tricolor 306-307, 314
    var. eumorphus 307
    var. indicus 307
    var. shoreicola 307
    var. tricolor 307
Pythium 156, 172
  aphanidermatum 157
  proliferum 156

Quadracaea **103**, 106-107
  mediterranea 103, **104**-105, 107-109

Ramalina
  fastigiata 422-423
  yemensis 418
Ramocladia
  reticulata 152
Ravenelia
  annulata 64
  bizonata 64
  cumminsii 64
  distans 64
  echinata
    var. ectypa 65
  ectypa 65
  expanse 65

[Ravenelia] faceta 65
  idonea 65
  irregularis 65
  rata 65
  sololensis 65
  theiseniana 65
Remispora
  crispa 398-400, 408
  galerita 398, 400, 408
  maritima 398, 408
  pilleata 398, 408
  quadriremis 398, 408
  spinibarbata 398, 408
  stellata 398, 409
Repetobasidiellum
  fusisporum 185
Rhizidiomyces
  bivellatus 156
Rhizidium
  endosporangiatum 167
  megastomum 167
  microcystidis 167
  parasiticum 167
  renifore 168
  tomiyamanum 168
Rhizoclosmatium
  hyalinum 168
Rhizophlyctis 168
  aurantiaca 168
  boninensis 168
  bonseyi 168
  columellae 168
  costatus 168
  fuscus 163, 168
  hirsutus 168
  ingoldii 168
  lovettii 168
  mastigotrichis 168
  oceanis 168
    var. floridaensis 168
  petersenii
    var. appendiculata 168
  reynoldsii 168
  rosea 152, 154, 168
  serpentina 168
  spinosa 161
  tropicalis 168
  variabilis 168
    var. burmaensis 168
  willoughbyi 168
Rhizophydium 164, 168
  achnanthis 160, 168
  aestuarii 164, 168
  anatropum 164, 168
  androdioctes 169
  angulosum 169
  annulatum 169
  aphanomycis 169
  aureum 169
  biporosum 169
  blastocladianum 169
  blyttiomycerum 169
  brevipes
    var. marinum 164, 169
  bumilleriae 164, 169
  capillaceum 169
  clavatum 169
  coleochaetes 154, 169
  collapsum 169
  conchiforme 169
  condylosum 169
  contractophilum 169
  coralloidum 169
  coronum 172
  difficile 160, 169
  digitatum 166, 169
  dubium 169
  echinocystoides 169
  ellipsoidium 164, 169
  elyensis 169
  fragilariae 160, 170
  fugax 170
  gonapodyanum 170
  hispidulosum 170
  horizontale 170
  karlingii 170
  lagenaria 170
  laterale 170
  lenelangeae 170
  littoreum 170
  macroporosum 170
  manoense 170
  melosirae 160, 170
  mougeotiae 170
  nobile 170
  novae-zelandiensis 164, 170
  obpyriformis 164, 170
  olla 164, 170
  patellarium 170
  pedicellatum 170
  pelagicum 170
  piriformis 160, 170
  planktonicum 170, 173
  poculiforme 170
  polystomum 170
  porosum 170
  proliferum 170
  punctatum 171
  rarotonganensis 171
  reflexum 171
  rhizinum 171
  rotundum 171
  scenedesmi 164, 171
  sibyllinum 171
  signyense 171
  skujai 164, 171
  sparrowii 171
  sphaerocarpum
    var. rhizoclonii 171
    var. spirogyrae 171
  sphaerotheca 171
  spinosum 149, 171
  spinulosum 164, 171
  squamosum 171

[Rhizophydium] stellatum 171
    stipitatum 171
    tenue 164, 171
    tetragenum 171
    tubulatum 171
    ubiquetum 171
    undatum 171
    undulatum 171
    urcelolatum 171
    venezuelensis 172
    venustum 172, 174
Rhizoplaca 423
    chrysoleuca 423
Rhodocybe
    mundula 220
    truncata 220
Rhodophyllus
    lanicus 216
    sinuatus 216
Rigidoporus 387, 389
Rimelia
    cetrata 418
    reticulata 426-427
Roestelia
    brucensis 65
Royoporus **143**, 147
    spathulatus **145**, 147
Rozella 172
    blastocladiae 172
    coleochaetis 172
    diplophlyctidis 172
    itersoniliae 172
    longicollis 172
    longisporangia 172
    parva 172
Rozellopsis 172
Ruminomyces 151, 172
    elegans 151, 172
Russula 471-472, 475, 477-478
    olivaceoviolacens 473

Sarocladium
    oryzae 209
Savoryella
    lignicola 398, 409
Schenella 82, 100-101
    microspora 82
    simplex 79, 81-82, 88, 92
Scherffeliomyces
    appendiculatus 157, 172
    leptorrhizus 157, 172
Scherffeliomycopsis 172
    coleochaetis 172
Scirrhia
    acicola 437
    pini 437
Sclerococcum
    parmeliae 415, **425**-426
    serusiauxii 424-425
    simplex 427
Scolecobasidiella 260
    tropicalis 260, 262
Scorpiosporium 455, 463
    angulatum 464
    anomalum 464
    gracile 464
    minutum 455, 463-464
Scutellospora 130, 135
    cerradensis 129, **130**-132, 134-136
    coralloidea 135
    fulgida 135
    gilmorei 135
    gregaria 135
    heterogama 135
    pellucida 135
    persica 135
    verrucosa 130, 135
Scytinostromella
    heterogenea 186
Sebacina 118
    epigaea 111, 118-119
Selenosporella 103-104, 106-107
Septochytrium
    willoughbyi 172
Septosperma 172
    anomala 172
    anomalum 172
    irregulare 151, 172
    multiforma 172
    multiforme 172
    rhizophidii 172
    rhizophydii 172
    spinosa 172
    spinosum 172
Serendipita
    vermifera 111, 120
Sigmoidea
    luteola 398-399, 410
Siphonaria
    variabilis 172
Sistotrema
    subtrigonospermum 186
Skierka
    holwayi 65
Sorateae
    holwayii 66
Sorochytrium 172
    milnesiophthora 173
Sparrowia 173
    parasitica 173
    subcruciformis 173
Sparrowmyces 173
    sparrowii 173
Sphaerella
    myricariae 439
Sphaeria
    myricariae 439
Sphaerita
    dinobryi 173
Sphaeromonas
    communis 153
Sphaerophragmium
    everinum 66

Sphaerulina
  oraemaris 398-399, 409
Spiculogloea 111-**112**
  occulta 111-**113**, 114
Spizellomyces 173
  acuminatus 164, 173
  dolichospermus 173
  kniepii 165, 173
  lactosolyticus 173
  palustris 165, 173
  plurigibbosus 166, 173
  pseudodichotomus 173
  punctatus 165-166, 173
Sporidesmium 278
Sporophlyctidium
  neustonicum 173
Sporothrix 209
  vizei 209
Stemonitis 91, 100
  axifera 85-86
    var. axifera 84-85
    var. smithii 85-86
  confluens 86-88
  flavogenita 93-94
  foliicola 91
  fusca 87
  herbatica 91
  hyperopta 79, 89-90, 92, 99
  microsperma 79, 90
  nigrescens 90-92, 99
  pallida 91, 99
  splendens 93-94
  virginiensis 90
Stemonitopsis
  hyperopta 89
  subcaespitosa 98, 100
Stigmina 435
  concentrica 435
Strigula 323, 326
  affinis 326
  australiensis 326
  johnsonii 326
  minutula 326
  occulta **323**-326
  stigmatella
    var. alpestris 326
  taylorii 323, 325
Strobilurus
  stephanocystis 220
Stropharia
  aeruginosa 218
  coronilla 218
  semiglobata 218
  stercoraria 218
Subulispora
  procurvata 373, 381-382
  rectilineata 373, 382-384
Suillus
  bellini 215
  boudieri 215
  bovinus 215
  granulatus 215
  luteus 215
  pictus 215
  variegatus 215
Symphytocarpus
  confluens 86-87
Synchytrium 149-150, 161, 173
  grandis 161
  namae 163

Talaromyces 476
Thekopsora
  pseudo-cerasi 63
Thermoascus 225-226, 228, 230
  aegyptiacus 230, 232, 238
  aurantiacus 226, 230, 232-235
    var. levisporus 230
  crustaceus 226, 230, 232, 235-239
  taitungiacus 225-**226**, 229-232
  thermophilus 230, 232
Thielavia 241, 244
  aegyptica 244
  appendiculata 244
  arenaria 244
  australiensis 244
  emodensis 244
  expansa 244
  fragilis 244
  heterothallica 244
  hyalocarpa 244
  hyrcaniae 244
  microspora 244
  minuta 244
  octospora 244
  peruviana 244
  pingtungia 241, **242**-246
  subthermophila 244
  terrestris 244
  tetraspora 244
  tortuosa 244
Thozetella
  cristata 373, 382-384
Ticogloea 260
  guttulata 260, 262
Tofispora
  repetospora 181
Torpedospora
  ambispinosa 398-399, 409
Torrendia
  pulchella 217
Trachypus
  pseudoscaber 215
Trametes 320
  feei 320
  suaveolens 320
Tremella 112
  foliacea 123
  mesenterica 123
Tricella
  acuminata 19
Trichocladium
  achrasporum 398, 410
  alopallonellum 398-399 ,410

[Trichocladium] constrictum 398-399, 411
Tricholoma
    albobrunneum 220
    aurantium 220
    auratum 220
    batschii 220
    caligatum 220
    flavovirens 220
    grammopodium 220
    melaleucum 220
    orirubens 220
    populinum 220
    rutilans 220
    sejunctum 220
    sordidum 220
    terreum 220
    virgatum 220
Tricladium 455, 463
    attenuatum 460
    minutum 455, **464**, 468
Triparticalcar 173
    arcticum 164, 173
Triphragmiopsis
    isopryri 66
Triphragmium
    isopryri 66
    koelreuteriae 17
Triposporium 275, 278
    deviatum 278
    elegans 278
Tritirachium
    oryzae 288
Tubaria
    furfuracea 220
    pellucida 220
    trigonophylla 220
Tuber 263, 365, 370-371
    candidum 365, 368
    excavatum 370
    lyonii 365-367, 369-371
    malacodermum 371
    melanosporum 371
    rufum 365, 368, 370-371
        var. nitidum 368, 370-371
        var. rufum 371
    spinoreticulatum 371
    texense 365-366, 368, 370
Tulasnella 122
    balearica 111, **121**-122
    brinkmannii 122
    calospora 122
    deliquescens 122
    pallida 123
    pallidocremea 122
    violea 123
Tylopilus
    felleus 215

Uredinopsis
    americana 66
    arthurii 66
    coplandii 66
    kameiana 66
    longimucronata 67
    struthiopteridis 67
    woodsiae 67
Uredo
    adianti-capilli-vernis 14
    apecheca 68
    aztechana 68
    cancellata 292
    cenchricola 293
    cyperi-tegetiformis 294
    detecta 67
    eleusine-indicae 293
    glumarum 299
    imperatae 295
    laeviuscula 17
    linearis
        var. b polypodii 14
    lini 15
    nassauviae 67
    nootkatense 13
    operculina 67
    phormi 68
    polypogonis 298
    schizachyrii 294
    scopelandii 16
    sphacelicola 68
    spirostachydis 67
    velata 45
    zeugitis 68
Uromyces 3, 291
    actinostemonis 71
    americanus
        var. californicus 70
    amoenus 69
    amurensis 72
    anguriae 70
    armeriae
        ssp. hudsonica 74
        ssp. pacificus 74
    asperulae 76
    aspiliae 69
    azukicola 72
    bauhiniicola 72
    beckmanniae 74
    bisbyi 75
    bradburyae 72
    cisneroanus 71
    clitoriae 72
    claytoniae 75
    cologaniae 72
    croci 73
    digitatus 74
    dolichosporus 69
    galii 76
    halstedii 74
    hardenbergiae 72
    hedysari-paniculati 72
    inaequialtus 70
    intricatus
        var. major 75
        var. nivea 75

[Uromyces intricatus] var. pluriporosus 75
    var. umbellati 75
  lapponicus
    var. oxytropis 72
  lezpedezae-procumbentis 72
  limonii-caroliniani 74
  linearis 300
  lineolataus
    ssp. nearcticus 71
  loranthi 74
  manihotus-catingae 71
  mexicanus 72
  neurocarapi 73
  nothoscordi 68
  novissimus 70
  oaxacanus 71
  oblectaneus 71
  occidentalis 73
  panici-sanguinalis 75
  peckianus 75
    ssp. rugulosa 75
  peracarpae 69
  pereskiae 73
  polycnemi 70
  primaverilis
    ssp. nothoscordi 68
    ssp. primaverilis 69
  probus 73
  psychotriae 76
  ratus 70
  ribicola 73
  rostratus 73
  rumicis 301
  salpichroae 76
  scutellatus 71
  senecionicola 69
  setariae-italicae 301
  shikokianus 73
  sisyrhynchii 73
  socius 74
  sparganii
    ssp. asiaticus 77
  sphaericus 69
  tolerandus 71
  tranzschelii 71
  trifolii-repentis 302
    var. trifolii-repentis 301
  unitus 76
    ssp. montanensis 76
    ssp. pacificus 76
    ssp. spraguae 76
    ssp. unitus 76
  vicinus 70
Uromycladium
  bisporum 77
  simplex 77
Uropyxis
  arisanensis 77
  diphysae 77
  holwayi 77
  petalstemonis 77
  wootoniana 11
Usnea 422-423
  florida 418

Varicosporium
  elodeae 463
Verticillium
  luteo-album 209
Vesiculomyces
  epitheloides 182
Volvariella
  bombycina
    var. maxima 216
  media 216
  speciosa 216
Vuilleminia 181, 187
  comedens 186-187
  cystidiata 187
  macrospora 187
  megalospora 187
  obducens 181, **186**-187
  subglobispora 187

Wettsteinina 434
  yuccigena 434

Xanthoria 421
  candelaria 421
  parietina 421-422, 425
Xenasma
  pruinosum 188
  pulverulentum 188
  rimicolum 188
Xenostele
  takakumensis 48
Xerocomus
  badius 215
  subtomentosus 215
Xeromphalina
  campanella 220
Xylaria 327, 338, 352, 356
  allantoidea 327-330
  apiculata 352
  arbuscula 352-354, 356-358
  badia 327, 329-330, 332
  castorea 344
  corniformis 337
  cubensis 327, 330, 332-334, 336, 338, 342
  curta 336-337, 354
  feejeensis 327, 337, 339, 344, 354
  frustulosa 338, 341
  grammica 327, 339-340, 342, 346, 348, 350, 352
  laevis 327, 334, 336, 342
  luteostroma 344
  luteostromata 327, 343-344
  mellisii 358
  multiplex 327, 344, 346-348, 350, 352
  pallida 327, 346, 348, 352
  papulis 327, 347-348, 350, 352
  poitei 327, 330, 333, 352
  polymorpha 356

[Xylaria] schreuderiana 352
    schweinitzii 351, 354, 356
Xylocoremium
    flabelliforme 336

Zalerion
    maritimum 398, 411
    varium 398, 411
Zeloasperisporium **284**-285
    hyphopodioides 283-**285**, 286-287
Zetiasplozna
    cordylines 199
Zygogloea 112
Zygorhizidium
    affluens 172-173
    asterionellae 173
    chlorophycidis 173
    cystogenum 174
    melosirae 174
    planktonicum
        f. asterionellae 174
        f. synedrae 174
    vaucheriae 174
    venustum 172, 174

Reviewers, Volume Sixty

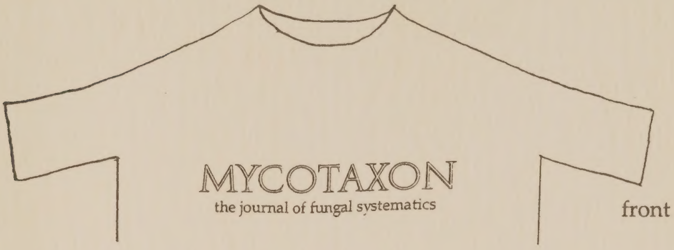
The Editors express their appreciation to the following individuals who have, prior to acceptance for publication, reviewed one or more of the papers appearing in this volume:

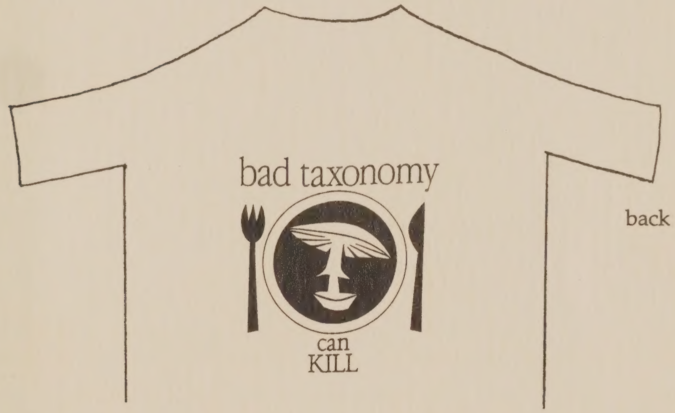
T. J. Baroni
D. J. S. Barr
M. E. Barr
G. H. Boerema
K. L. Braun
H. H. Burdsall, Jr.
R. F. Castañeda Ruíz
G. B. Cummins
E. Descals
W. Gams
E. B. Gareth Jones
R. L. Gilbertson
J. H. Ginns
J. Guarro
R. E. Halling
D. M. Henderson
G. L. Hennebert
Y. Hiratsuka
E. Horak
Y.-M. Ju
H. W. Keller
B. Kendrick
J. W. Kimbrough
J. J. Kohlmeyer
C. Lado
T. Læssøe
M. J. Larsen
D. Malloch
D. W. Mitchell
J. B. Morton
D. N. Pegler
D. H. Pfister
M. Rajchenberg
A. W. Ramaley
P. Roberts
J. D. Rogers
A. Y. Rossman
C. Roux
K. A. Seifert
E. Sérusiaux
C. A. Shearer
C. V. Subramanian
D. Triebel
R. E. Tulloss
C. Walker
C. J. K. Wang
J. Webster
J. E. Wright

Publication Date Volume Fifty-Nine

MYCOTAXON for July-September 1996, volume 59: 1-524
was issued on September 18, 1996.

MYCOTAXON T-SHIRTS NOW AVAILABLE


MYCOTAXON
the journal of fungal systematics
front


bad taxonomy
can
KILL
back

You may contact Mycotaxon, Ltd.
by e-mail at <rkorf@innet.com>, or by fax at (607) 273-4357,
or by mail at Mycotaxon, Ltd., P.O. Box 264. Ithaca, NY 14851
for prices and ordering information

Sizes: M, L, and XL, for chest sizes 38-40, 42-44, and 46-48 inches,
in 100% pre-shrunk cotton, maroon lettering on white shirt

Reduced price for Mycotaxon subscribers

EDITORS OF MYCOTAXON

JEAN BOISE CARGILL, *Editor-in-Chief*
Harvard University Herbaria, 22 Divinity Ave.
Cambridge, MA 02138, U.S.A.

ASSOCIATE EDITORS

Karen Gettelman *Index Editor* Indiana University Bloomington, IN	David S. Hibbett *Book Review Editor* Harvard Univ. Herbaria, Cambridge, MA USA	G. L. Hennebert *French Language Editor* 32 Rue de l'Elevage B-1340 Ottignies - LLN Belgium	Pavel Lizon *Asst. to the Ed.in-Chief* Plant Pathology Herbarium, Cornell Univ. Ithaca, NY USA

MYCOTAXON is a quarterly journal devoted to all phases of mycological taxonomy and nomenclature. All articles are reviewed by specialists prior to acceptance. Publication is open to all persons. Papers may be in French or in English. Summaries in those or any additional languages desired by the authors are given for longer articles. Printing is on high quality, acid-free book paper. Authors prepare their own *camera-ready* copy after having received critical comments from pre-submission reviewers. *Instructions to Authors* appeared in MYCOTAXON 50: 493-497. 1994. A copy of these instructions will be sent upon request to the Editor-in-Chief.

SUBSCRIPTION INFORMATION

Each volume, beginning with volume 3, contains at least 512 pages, and consists of an *irregular* number of quarterly issues (rarely an *additional* issue, a Festschrift, may be included in a volume). Each issue of MYCOTAXON varies in number of pages. Subscriptions are normally on a *per volume* basis, but subscribers may choose an *annual* basis to avoid frequent billing. Currently this would involve prepaying three volumes. *Personal subscriptions* are available at a substantially reduced rate for *individuals* who agree not to deposit their copies in another library than their personal one within 3 years of receipt. Address all orders to the Mycotaxon Order Department, *not* to the Editors. Prices beginning with volume 53 are:

	USA	Canada/Mexico	Other Foreign (Air)
REGULAR (multiuser)	$65.00	$67.00 U S	$70.00 U S
PERSONAL (individual)	$30.00	$32.00 U S	$37.00 U S

(*All back volumes are still available.* All *complete* volumes are available at $30.00 per volume when shipped by *surface mail,* $45 per volume by *air mail,* except vols. 1, 34 and 46 available only in complete runs.)

Place subscriptions through the ORDER DEPT., MYCOTAXON, LTD., P. O. BOX 264, ITHACA, NY 14851-0264, U. S. A., or through your agent. MYCOTAXON may also be obtained on a journal-exchange basis. This may be arranged with journals, institutions, or individuals who have difficulty in obtaining foreign currency.

TWENTY-VOLUME CUMULATIVE INDICES, 1974-1984 & 1984-1991

MYCOTAXON CUMULATIVE INDEX FOR VOLUMES I-XX (1974-1984) by Richard P. Korf & Susan C. Gruff (ISBN 0-930845-00-5) is available at $17.50 *postpaid*, and MYCOTAXON CUMULATIVE INDEX FOR VOLUMES XXI-XL (1984-1991) by Richard P. Korf & Susan C. Gruff (ISBN 0-930845-01-3) is available at $30.00 *postpaid*, MYCOTAXON, LTD., P. O. BOX 264, ITHACA, NY, 14851-0264, U.S.A.

AVAILABILITY IN MICROFORM, TEAR SHEET & PHOTOCOPY

MYCOTAXON is also available in *microfiche* and in *microfilm* from University Microfilms, 300 North Zeeb Road, Ann Arbor, MI 48106, U.S.A., or 30-32 Mortimer Street, London W1N 7RA, England, from whom prices may be obtained. Tear sheets or photocopies of individual articles may be obtained through *The Genuine Article™*, I.S.I., 3501 Market Street, Philadelphia, PA 19104, U.S.A.

RECENT BOOK PUBLISHED BY MYCOTAXON, LTD.

FUNGI OF CHINA by S. C. Teng (1996), edited by Richard P. Korf, 586+xiv pp., cloth-bound, 8-1/2 x 11 inches, 426 illustrations, 1 map, 1 photograph, $79 postpaid.

CONTACTING MYCOTAXON'S ORDER DEPARTMENT BY E-MAIL OR FAX

To reach the Order Department for information or placing orders, you may E-Mail to rkorf@innet.com or you may FAX to Richard Korf at (607) 273-4357.

NEW ! VISIT MYCOTAXON ON WORLD WIDE WEB AT **www.mycotaxon.com**